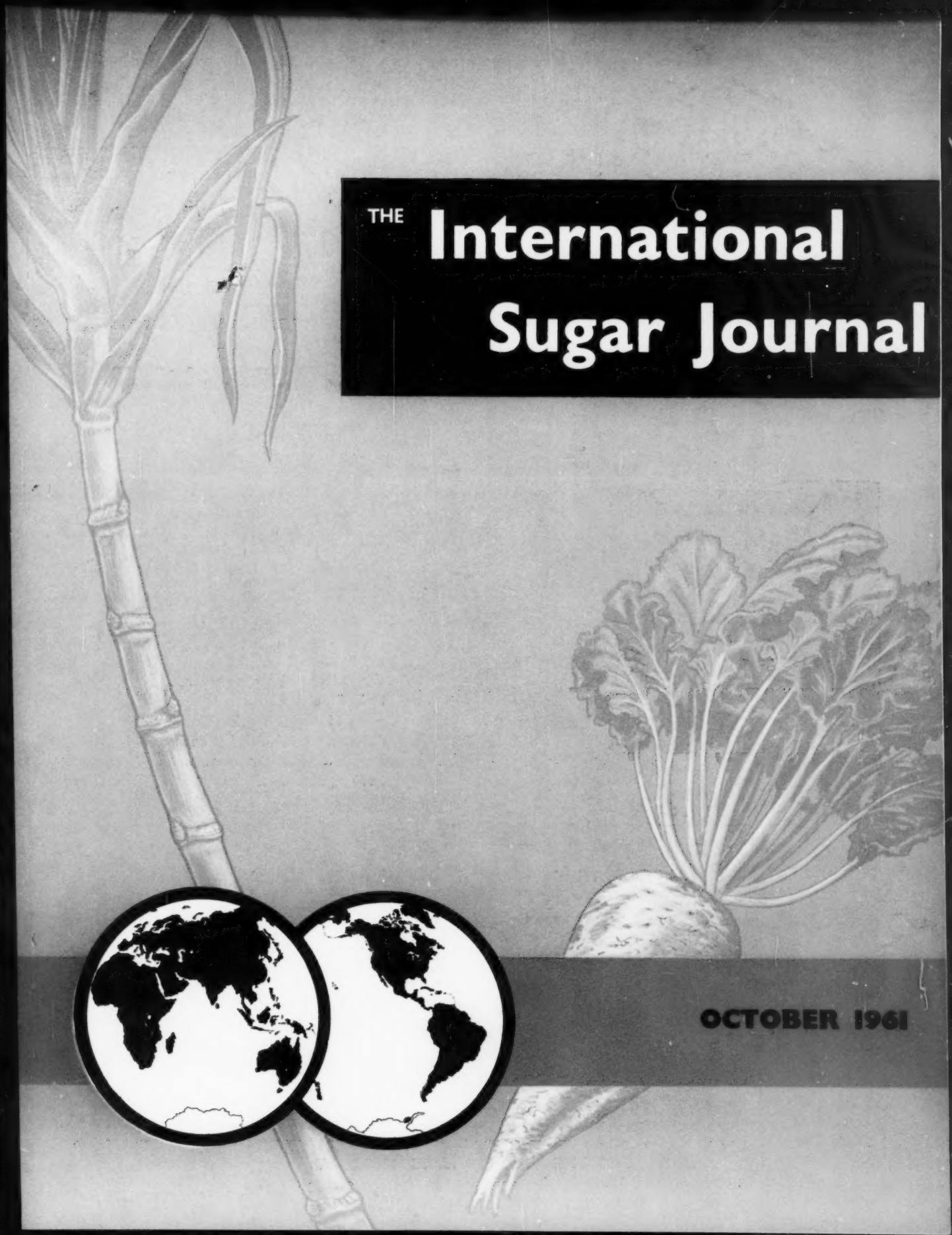


THE International Sugar Journal

OCTOBER 1961

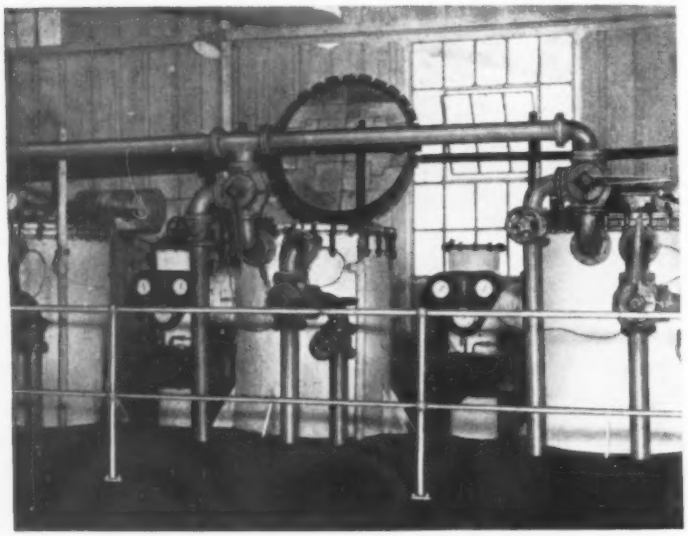
BLAIRS

COMPLETE

SUGAR

FACTORIES & REFINERIES

DISTILLERIES, ABSOLUTE ALCOHOL & CHEMICAL PLANTS



Our illustration shows three Mild Steel Vertical Juice Heaters, 3′ - 6″ diameter x 13′-0″ long, each having a heating surface of 1,000 square feet.

Sole Makers of
MULTIPLEX FILM
EVAPORATORS.

BLAIRS LIMITED

WOODVILLE STREET · GLASGOW S.W.1

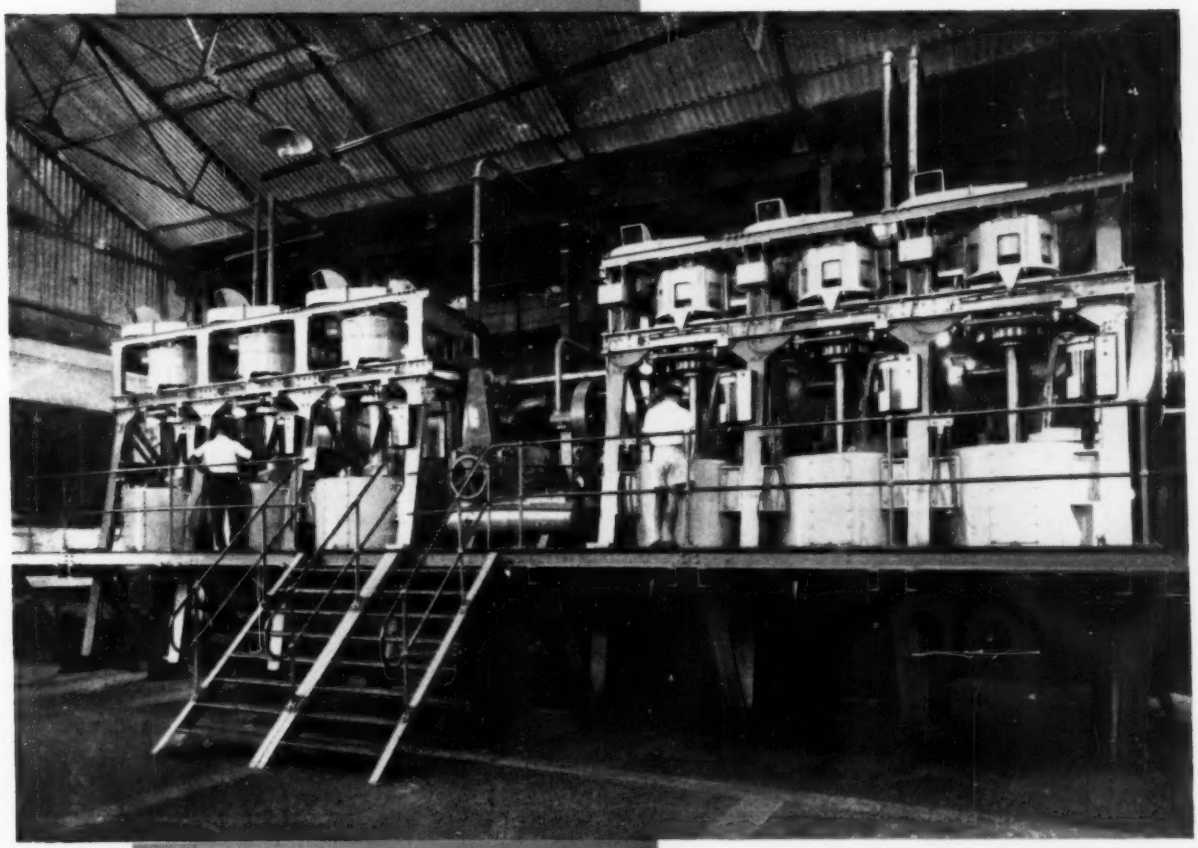
Cables — "BLAZON GLASGOW"

LONDON OFFICE —38 GROSVENOR GARDENS, S.W.1 · Cables — "MULTIVAP SOWEST LONDON"

A MEMBER OF THE MIRRLEES WATSON GROUP.

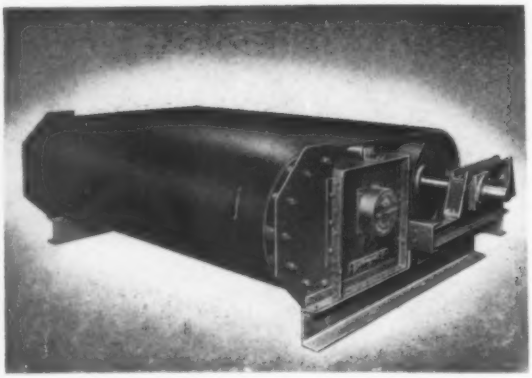
BROADBENT

A total of 64 Broadbent Sugar Centrifugals were supplied to Central and South Africa for the 1960 campaign.
This brings the number installed in the area since 1954 to 229 machines.

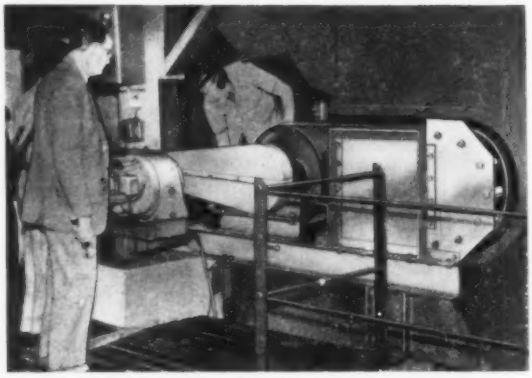


THOMAS BROADBENT & SONS LTD.
CENTRAL IRONWORKS HUDDERSFIELD ENGLAND
TELEPHONE 5520-5 TELEGRAMS 'BROADBENT' HUDDERSFIELD

MAGNETIC CONVEYOR HEAD



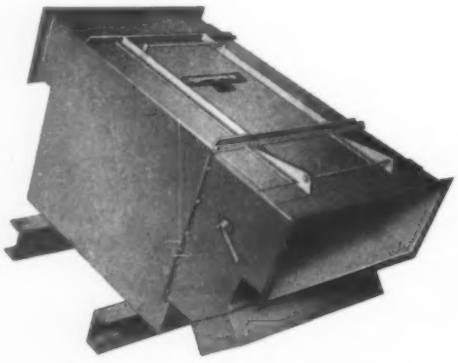
Boxmag patent MH. 2484. Conveyor Head built into an 84" wide short belt conveyor, photographed prior to despatch. The machine is designed for installation, as shown on the adjacent illustration.



Boxmag patent MH. 2484 installed in the chute between a sugar cane carrier and crusher, at a factory in Mauritius. It is designed to remove tramp metal automatically and continuously without an operator's attention. (write for leaflet 62/2).

MAGNETIC SEPARATORS PROTECT MACHINERY AND PRODUCTS

(Write for further details)



Boxmag Superflux Magnetic Chute for removal of ferrous contamination from refined sugar to decontaminate the product.

A Boxmag Unimajor block type Permanent Magnet. One of the many types of separators suitable for general applications in sugar factories. (write for details of full range).

BOXMAG

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ELECTROMAGNETS LTD

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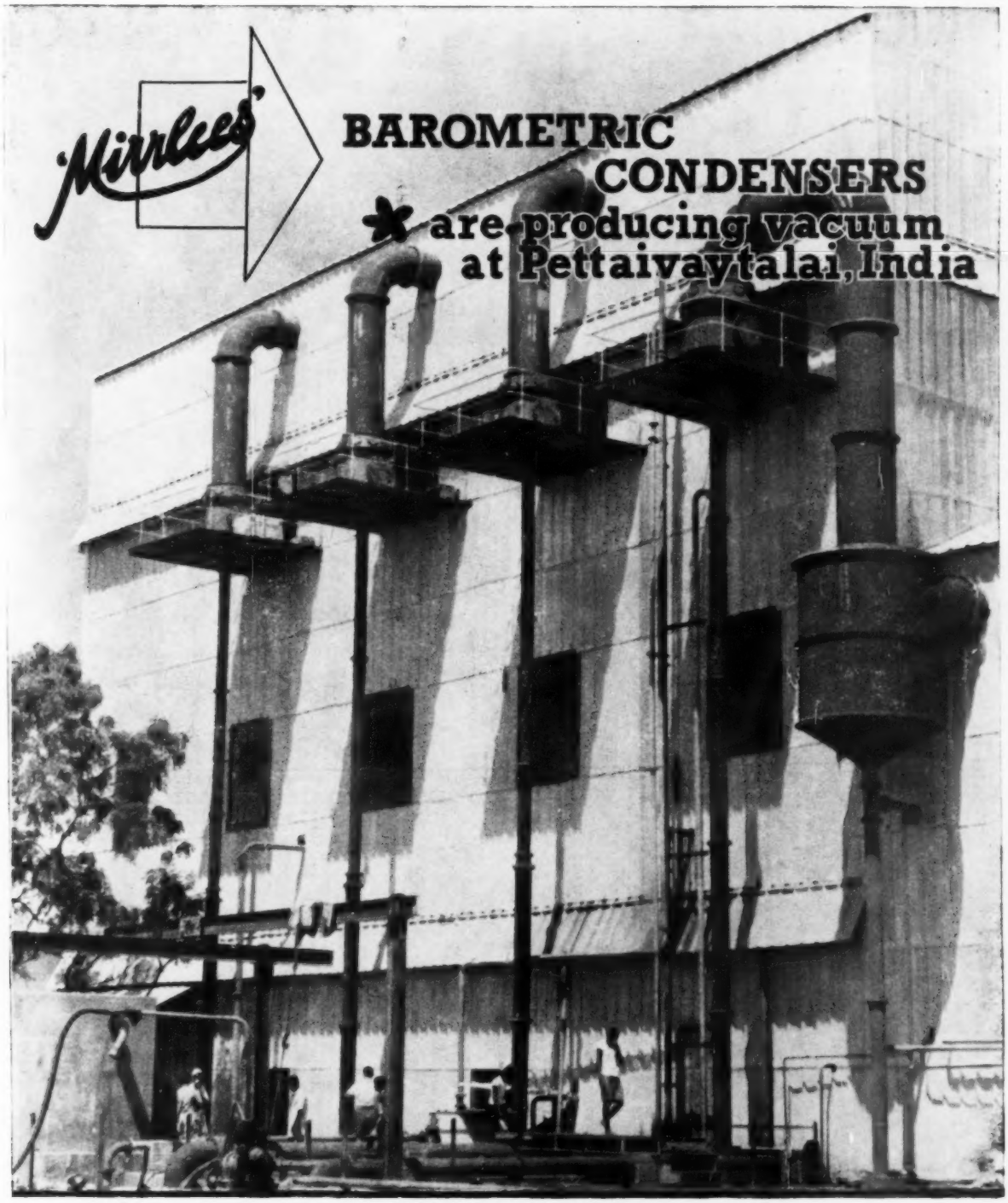


vacuum without moving parts

For Factories with suitable water conditions Mirrlees Barometric Condensers, having no mechanically moving parts, produce vacuum with trouble-free operation and little or no maintenance.

Of the three types of Barometric Condensers manufactured by Mirrlees, the Multi-Jet Spray is shown installed at Pettaivaytalai. The other types are Multi-Jet and Counter Current Tray.

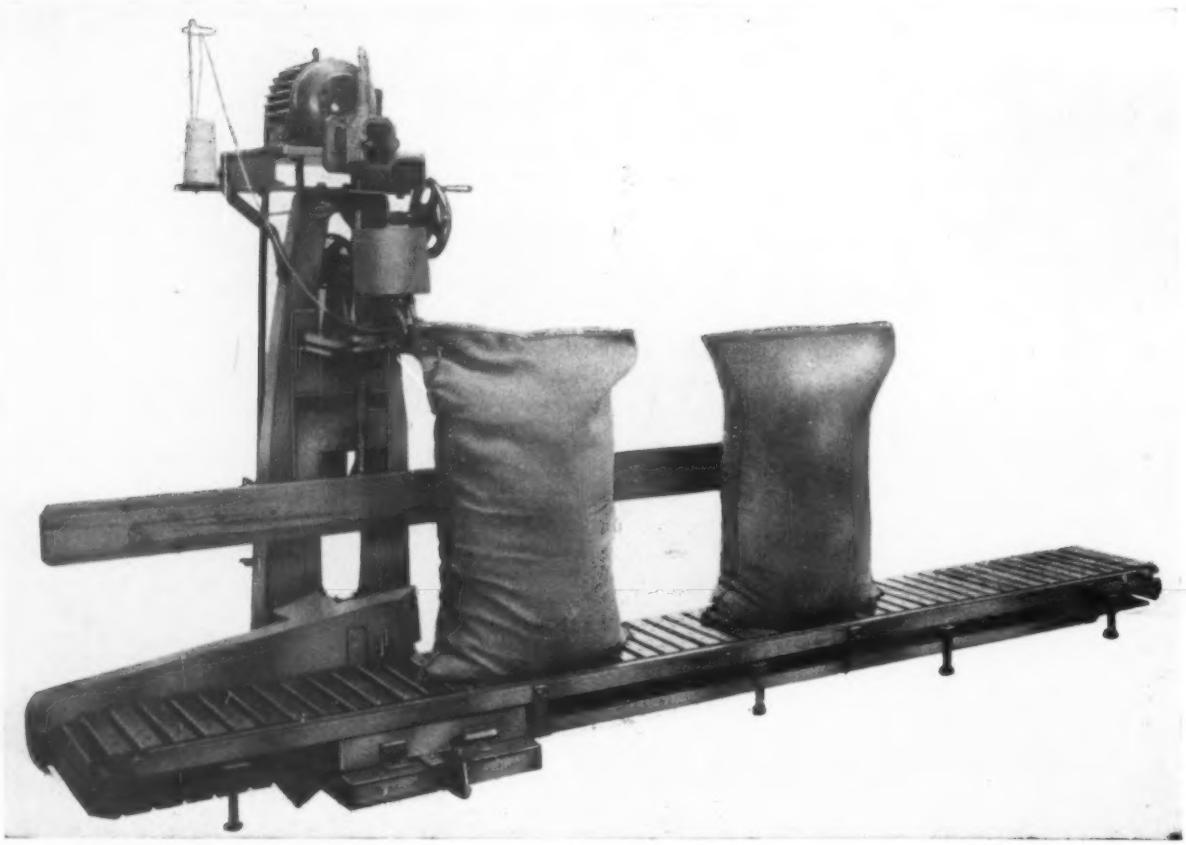
THE MIRRLEES WATSON COMPANY LIMITED

HEAD OFFICE AND WORKS—45 SCOTLAND STREET, GLASGOW, SCOTLAND CABLES: "MIRRLEES GLASGOW"
LONDON OFFICE 38 GROSVENOR GARDENS, S.W.1. CABLES: "MIRRLEES SOWEST LONDON"

The 'Super' Universal Sack Closing Machine

MODEL NO. 5B

Fitted with 10 or 12 ft. Conveyor and Special Clutch Drive



This machine is fitted with a conveyor 10 or 12 ft. overall and a Special Clutch Drive which allows the conveyor to be run independently of the sewing head.

Jute, Hessian, Paper Lined Hessian, Cotton and Paper Sacks weighing from 50 to 325 lbs. can be sewn on this machine.

Machines can be seen working by appointment.

Power required 2 h.p. **Shipping weight : 14 cwts.**

Manufactured in Great Britain by :

The Sack Filling & Sewing Machine Syndicate Limited

(Timewell's Patent)

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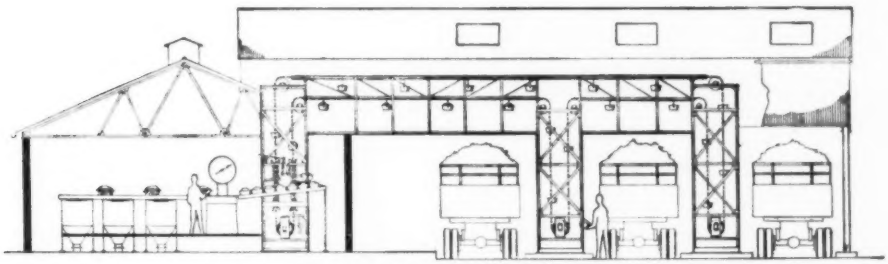
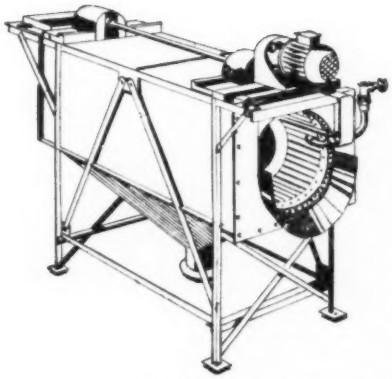
TAREHOUSE EQUIPMENT

AS SUPPLIED TO THE BRITISH & EIRE SUGAR CORPORATIONS AND TO MANY OF THE SUGAR BEET SEED GROWERS



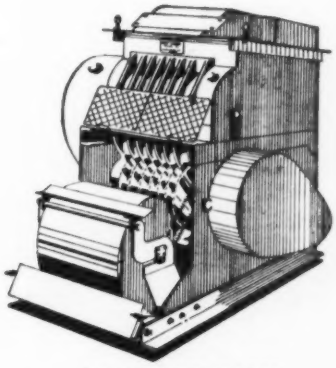
SAMPLES CONVEYOR

Combining regulated feed of samples direct from **lorry, and** *safety by elimination of road crossing by the operators*



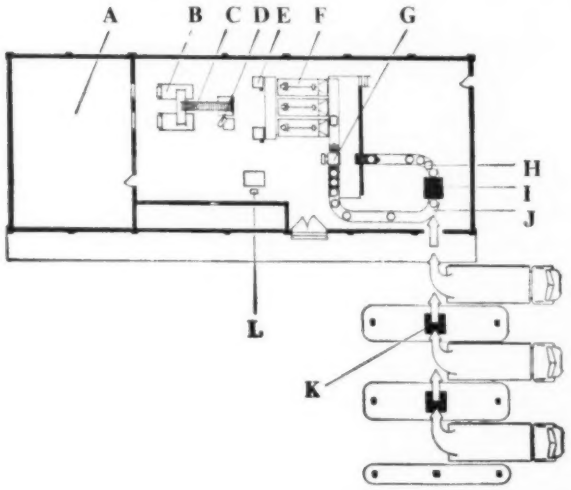
SPRAY WASHER

Using water at 90 lb. p.s.i. ensures clean roots 20 samples each of 50 lbs. handled per hour. Speed of drum easily variable between 3 and 22 r.p.m. to suit type and quantity of dirt adhering to sample roots.



MULTIPLE SAW

Takes up to 100 lbs. of roots, handling a 30 lb. sample in 25 secs. and producing a representative sample of brei.



A TAREHOUSE LAYOUT

– *handling 650 samples per day.*

A *Laboratory*
B *Multiple Saw*
C *Elevator*
D *Scales (Clean)*
E *Topping Tables*
F *Spray Washer*
G *Scales (Dirty)*
H *Empty Pannikins*
I *Unloading Leg of Samples Conveyor*
J *Full Pannikins*
K *Loading Leg of Samples Conveyor*
L *Recorder*

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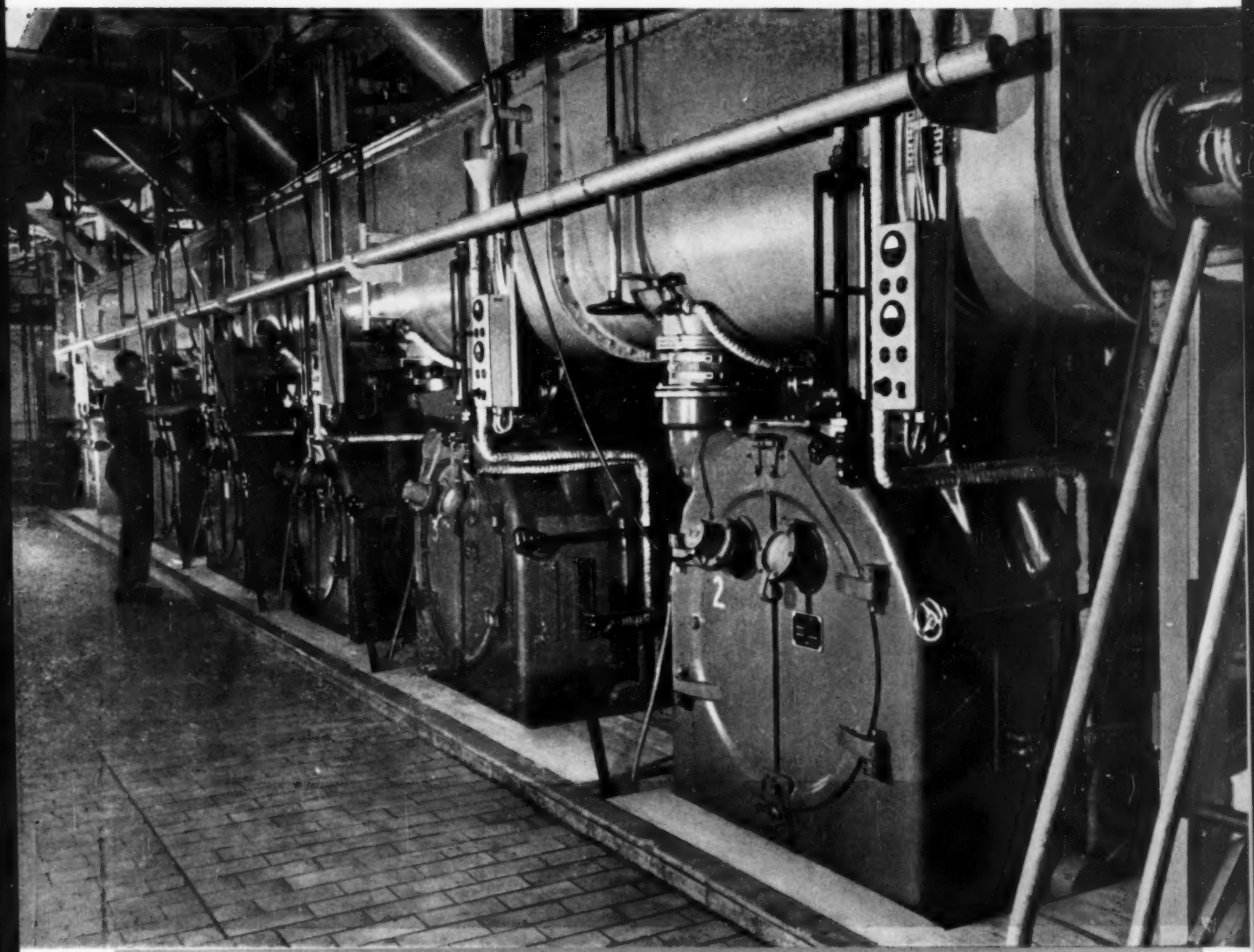
Electrical Plant Division, Stafford
WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

ESCHER WYSS

continuous centrifuges for the sugar industry

A battery of six push-type centrifuges, Model C 4 for medium-product sugar and affinated low-grade sugar, installed at Groningen Sugar Factory / Holland



Escher Wyss Ltd., Zurich/Switzerland
London Office: Escher Wyss Ltd.,
Terminal House, Grosvenor Gdns., London, S. W. 1, Phone Sloane 8101

Fully automatic!

the new

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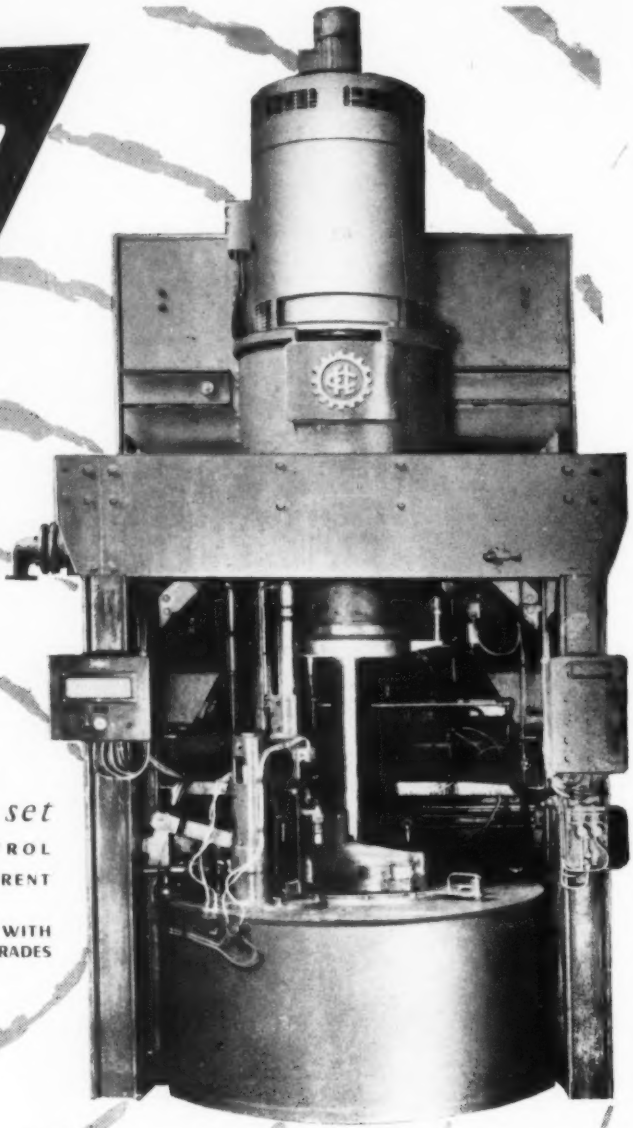
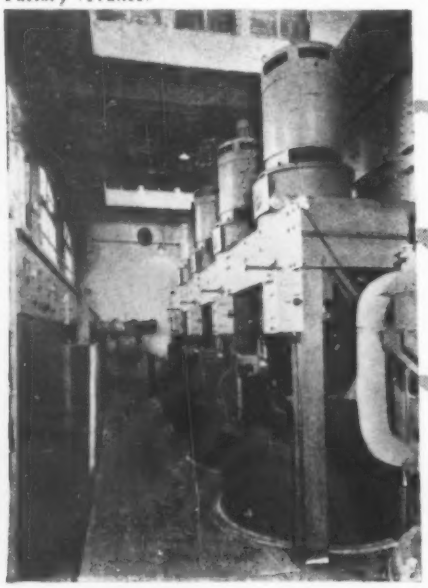


driven by
WARD-LEONARD *set*

- ELECTRONIC CONTROL
- ELIMINATION OF CURRENT PEAKS
- RECORD PRODUCTION WITH MASSECUITES OF ALL GRADES

Battery of 4 centrifugals at the Fontaine-le-Dun Sugar Factory (France)



S.A.G. - PARIS

FIVES LILLE - CAIL

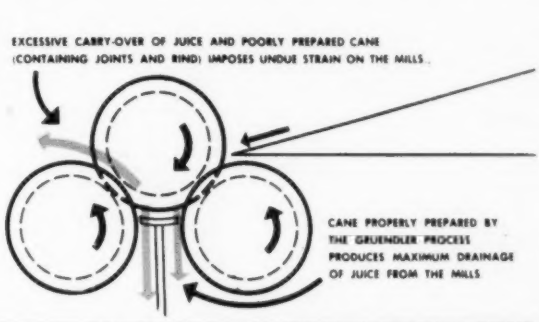
7, rue Montalivet, PARIS (8e) - Tél.: ANJou 22-01 et 32-40

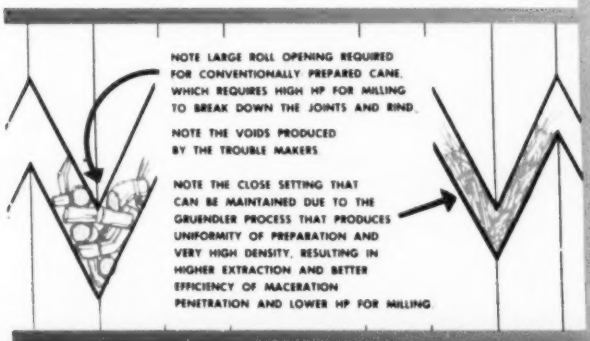
TROUBLE MAKERS IN CANE MILLING

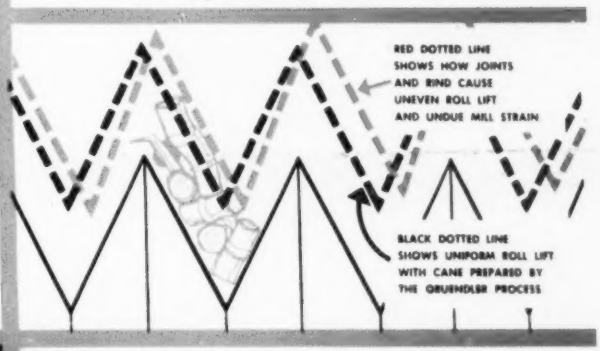
The most satisfactory milling of cane cannot be attained by double knifing of the cane alone. Many trouble makers are apt to develop, as shown by the sketches below.

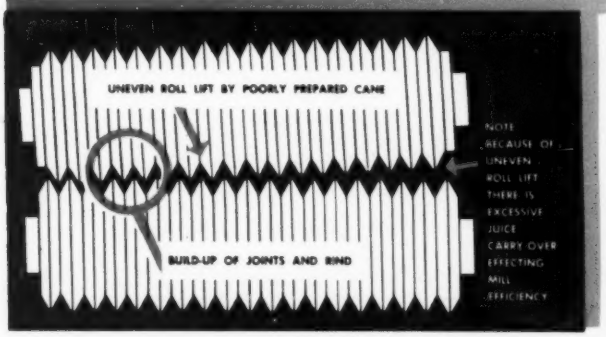
By comparison, the Gruendler Process of shredding reduces voids, increases cane density and completely processes the joints and rind . . . so that the mill has only the function of rolling the juice out of the cane.

Actual photo of cane prepared by the double-knife process. First knife was set 12" above the carrier and the second knife 1" above the carrier. Notice the preponderance of trouble makers: joints, splinters and rind.


EXCESSIVE CARRY-OVER OF JUICE AND POORLY PREPARED CANE (CONTAINING JOINTS AND RIND) IMPOSES UNDUE STRAIN ON THE MILLS.
CANE PROPERLY PREPARED BY THE GRUENDLER PROCESS PRODUCES MAXIMUM DRAINAGE OF JUICE FROM THE MILLS


NOTE LARGE ROLL OPENING REQUIRED FOR CONVENTIONALLY PREPARED CANE, WHICH REQUIRES HIGH HP FOR MILLING TO BREAK DOWN THE JOINTS AND RIND.
NOTE THE VOIDS PRODUCED BY THE TROUBLE MAKERS
NOTE THE CLOSE SETTING THAT CAN BE MAINTAINED DUE TO THE GRUENDLER PROCESS THAT PRODUCES UNIFORMITY OF PREPARATION AND VERY HIGH DENSITY, RESULTING IN HIGHER EXTRACTION AND BETTER EFFICIENCY OF MACERATION PENETRATION AND LOWER HP FOR MILLING


RED DOTTED LINE SHOWS HOW JOINTS AND RIND CAUSE UNEVEN ROLL LIFT AND UNDUE MILL STRAIN
BLACK DOTTED LINE SHOWS UNIFORM ROLL LIFT WITH CANE PREPARED BY THE GRUENDLER PROCESS


UNEVEN ROLL LIFT BY POORLY PREPARED CANE
BUILD-UP OF JOINTS AND RIND
NOTE BECAUSE OF UNEVEN ROLL LIFT THERE IS EXCESSIVE JUICE CARRY OVER EFFECTING MILL EFFICIENCY

THE GRUENDLER CANE SHREDDING PROCESS ALWAYS PREPARES CANE PROPERLY

Increases capacity

Increases sucrose extraction

Reduces bagasse moisture

Reduces mill strain

Eliminates most tramp iron

Lowers steam requirements

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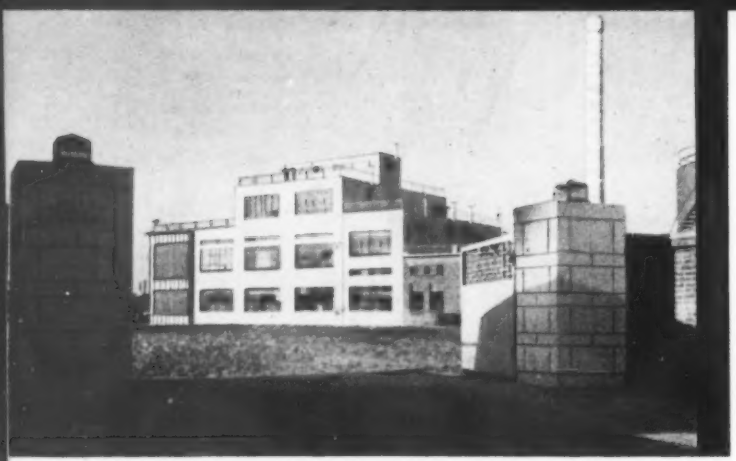
molasses

High-quality alcohol for human consumption and industrial use	rectified spirit 96,5 % vol.	active dry baker's yeast (saccharomyces)	In granules 92 % dry substance can be stored without losing its baking power
Used as power fuel for addition to motor car petrol	absolute alcohol 99,8 %	Baker's yeast (saccharomyces)	28 % dry substance
For various industrial uses	glacial acetic acid 99 %	Nutrient yeast (torulopsis)	For human consumption high protein and vitamin content used as substitute for meat
Used as solvent for paint and lacquer industry	ethyl acetate	fodder yeast (torulopsis)	Used as additive to animal fodder with high protein and vitamin content



Further plants for: CO_2 or dry-ice production · Utilization of slop

BMA is well-known for the delivery of complete sugar plants and plants for the utilization of molasses according to modern technology.

Our specialists will give you any detailed information you require for the most profitable utilization of molasses. For further information write for our leaflet "Profitable Utilization of Molasses"

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BMA
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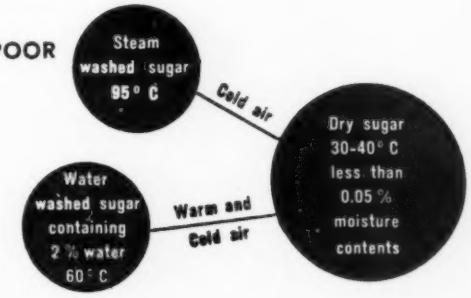
WERKSPOOR grasshopper type dryer-cooler at First Netherlands Co-operative Beet Sugar Factory "Sas van Gent"

This new* WERKSPOOR *grasshopper type dryer-cooler keeps the lustre of your sugar

with its simple and low construction, economical working, built in any capacity you may require, this modern WERKSPOOR apparatus will guarantee you:


Steam washed sugar 95° C
Cold air
Dry sugar 30-40° C less than 0.05 % moisture contents
Water washed sugar containing 2 % water 60° C
Warm and Cold air

- **absolutely undamaged crystals**
- **drying and cooling in record time**
- **close contact air-sugar**
- **completely dust free atmosphere**

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For grasshopper type dryer-coolers please apply to Werkspoor, Amsterdam

Baudouin

1949 1960

eleven years of maintenance free service

Vermillion Sugar Milling Tandem, which for many years operated in Louisiana, was dismantled late in 1960 and the equipment sold to the Osceola Farms Company, Florida, U.S.A. Inspection of the Edwards Accumulators, at the request of the new owners, was made. These units were found to be in perfect working order *after* 11 *years of continuous service.*

We at Edwards are proud of such performance! The *patented Edwards Hydraulic System has been successfully installed in over 480 sugar mill factories in 49 areas throughout the world.
We are represented in most sugar producing countries. For information and literature, please contact your nearest agent, or write directly to us at New Orleans.

*U.S. Patent	2,691,339
Cuban Patent	15,078
French Patent	1,020,656
British Patent	678,053
Mexican Patent	52,402

Patents Pending other countries.

EDWARDS
ENGINEERING CORPORATION
1170 CONSTANCE STREET · NEW ORLEANS 13, LA. · U.S.A.

Cut corrosion problems on intermediate cane carriers...

EXCEPTIONAL DURABILITY is built into links through heavy cross-section reinforced-rib design. Extra-broad fillets—on both sides of each link—add greatly to the strength and rigidity of driving lugs . . . minimize chain fatigue and distortion from stresses of repeated sprocket engagement.

HIGH WEAR-RESISTANCE is provided by large shoes with generous sliding surfaces. Besides resisting wear, the shoes prevent tilting, lessen the load on the pins and reduce joint wear.

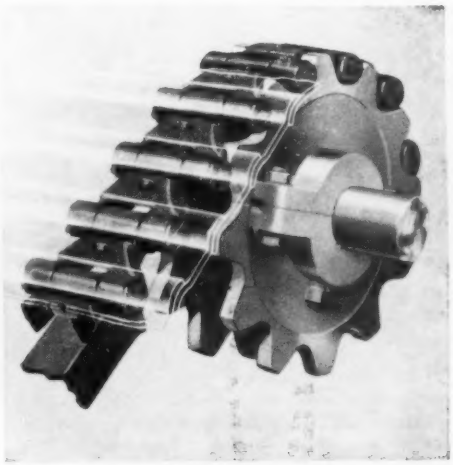
PROLONGED CHAIN LIFE is promoted by precision fit of all chain joint parts. Bushings are pressed and locked into the chain link. Longer chain life can be economically obtained by repinning and rebushing the links. Cotters permit easy disassembly.

Specify Link-Belt 901-E42 Chain

Whatever your corrosion problems, Link-Belt can supply the correct chain in a range of alternate metals for links, pins and bushings. Just state your requirements and Link-Belt will supply a *job-tailored* chain you can count on for long, low-cost operation.

Link-Belt 901-E42 chain with copper-bearing Promal links and stainless steel pins and bushings is normally preferred. Also available: links of stainless steel, bronze or copper-bearing malleable iron in combination with pins and bushings of stainless steel, bronze or case-hardened steel. For *greatest* corrosion resistance, chains made entirely of stainless steel are recommended.

For full details on all Link-Belt intermediate cane carrier chains as well as companion sprockets and slats, call your Link-Belt representative. Or write direct for Book 2640 covering our entire line of sugar-handling equipment.



QUALITY COMPANIONS: Link-Belt *double sprockets.* Link-Belt also furnishes properly matched **slats.**

LINK-BELT

CHAINS AND SPROCKETS

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LINK-BELT COMPANY: Engineers • Manufacturers • Exporters of Machinery for Handling Materials and Transmitting Power Established 1875.
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in the metallurgical development
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The resources of Yorkshire Imperial Metals Limited are devoted solely to the manufacture of non-ferrous tubes, plates and fittings, and plastic tubes and fittings. They have long been intimately associated with the Sugar Industry, both at home and overseas, and have made a careful study of the varied and often arduous operating conditions which obtain in the Industry. This study has resulted in the development of improved tube and plate alloys, metallurgically designed and scientifically manufactured to give the best possible service. This unrivalled experience is at your service, free of charge and without obligation, to assist in the solution of problems of all kinds affecting the life and use of non-ferrous tubes and plates.

Yorkshire Imperial craftsmanship, metallurgical skill and specialised experience, together with modern plant and methods and accurate control at every stage of manufacture, account for the enviable reputation which *Yorkshire Imperial* tubes and plates and *Yorkshire Imperial* fittings have achieved in their respective fields.

TUBES IN "YORCORON" · "KUNIFER 10" · COPPER AND "SEVA" BRASS · PLATES IN A WIDE RANGE OF ALLOYS · BI-METAL TUBES AND PLATES.

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The Crystalloscope is an instrument designed for controlling and improving the process of sugar boiling. It also finds application in some fields of the pharmaceutical and chemical industries.

The Crystalloscope revolutionizes the conventional process of sugar boiling by dispensing with the use of sampler tap, and increasing the economy of sugar production by 15%.

The high efficiency involved in its use makes the Crystalloscope suitable for checking the process of preparing primary, intermediate and final products as well as refinements.

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BUCKAU-WOLF centrifugal

is capable of dealing with

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in

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Special characteristics:

Bottom valve, travelling washing nozzle, pressure accumulators

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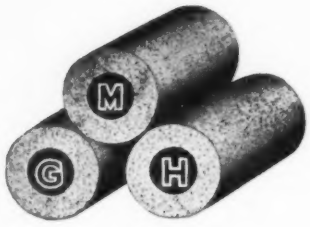
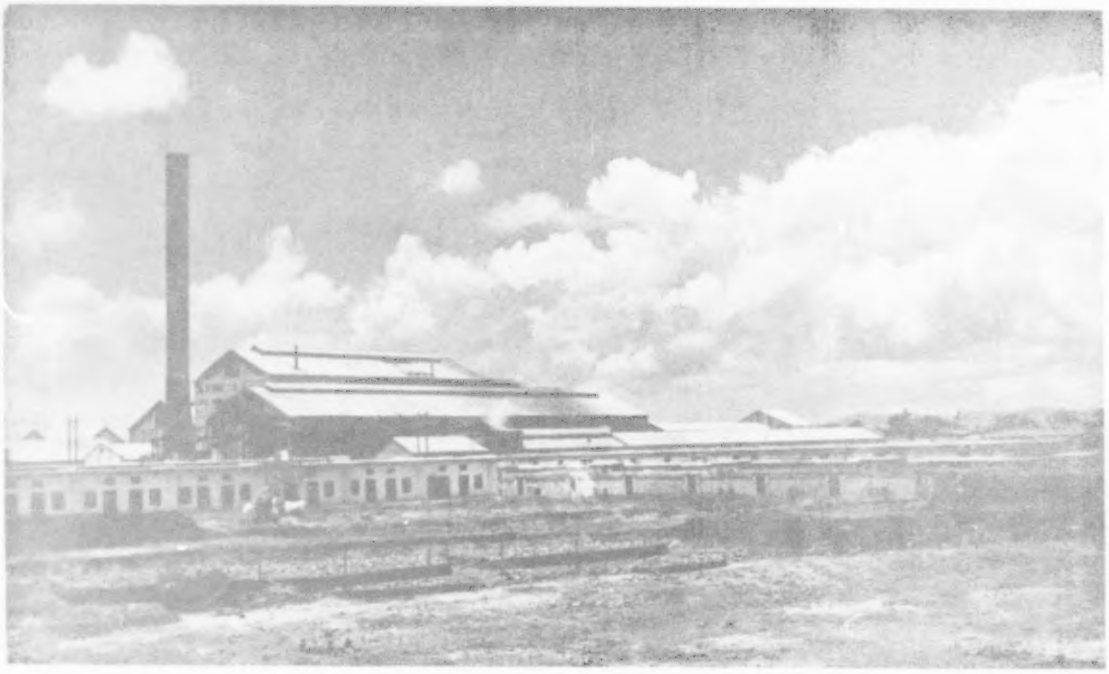
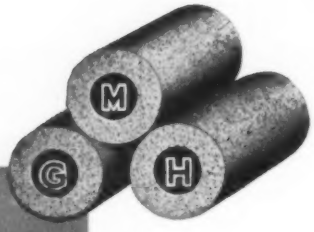




Sugar-Mill Rollers



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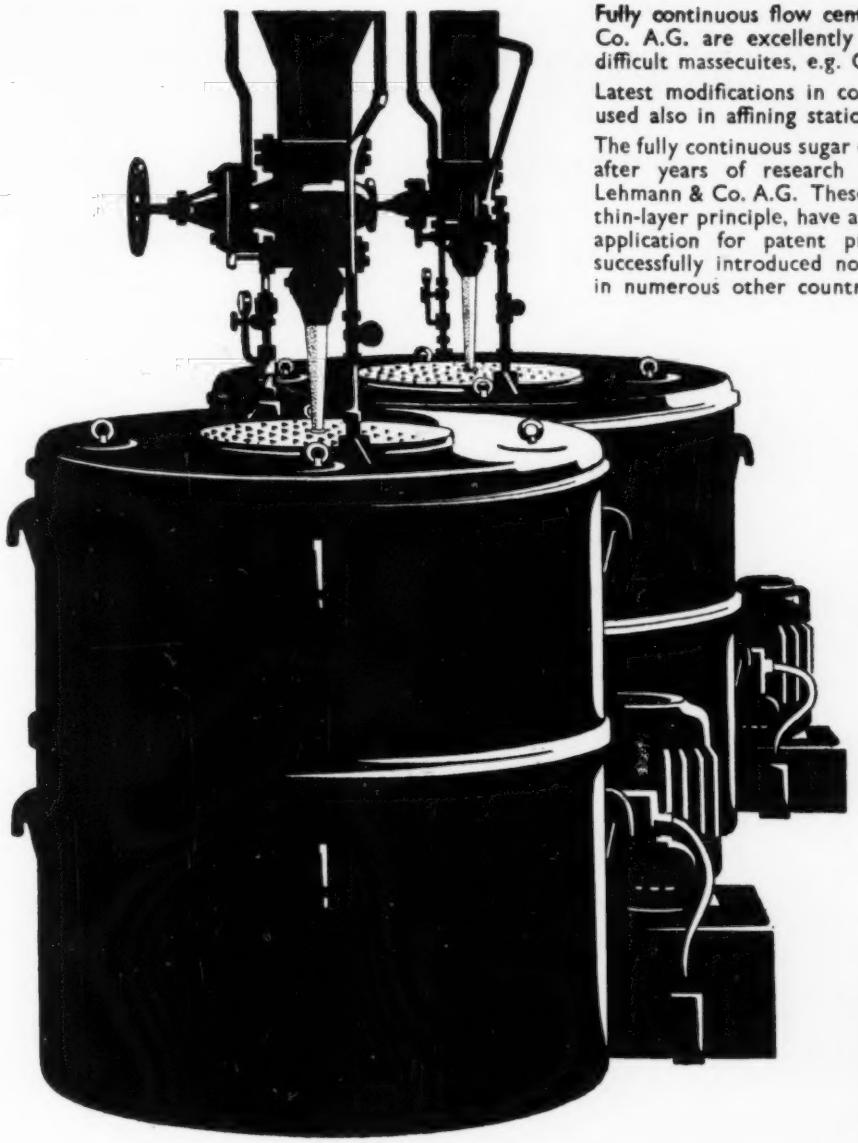

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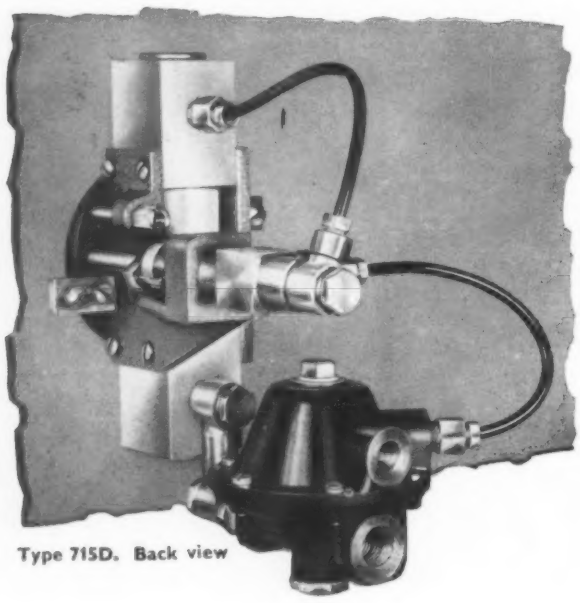

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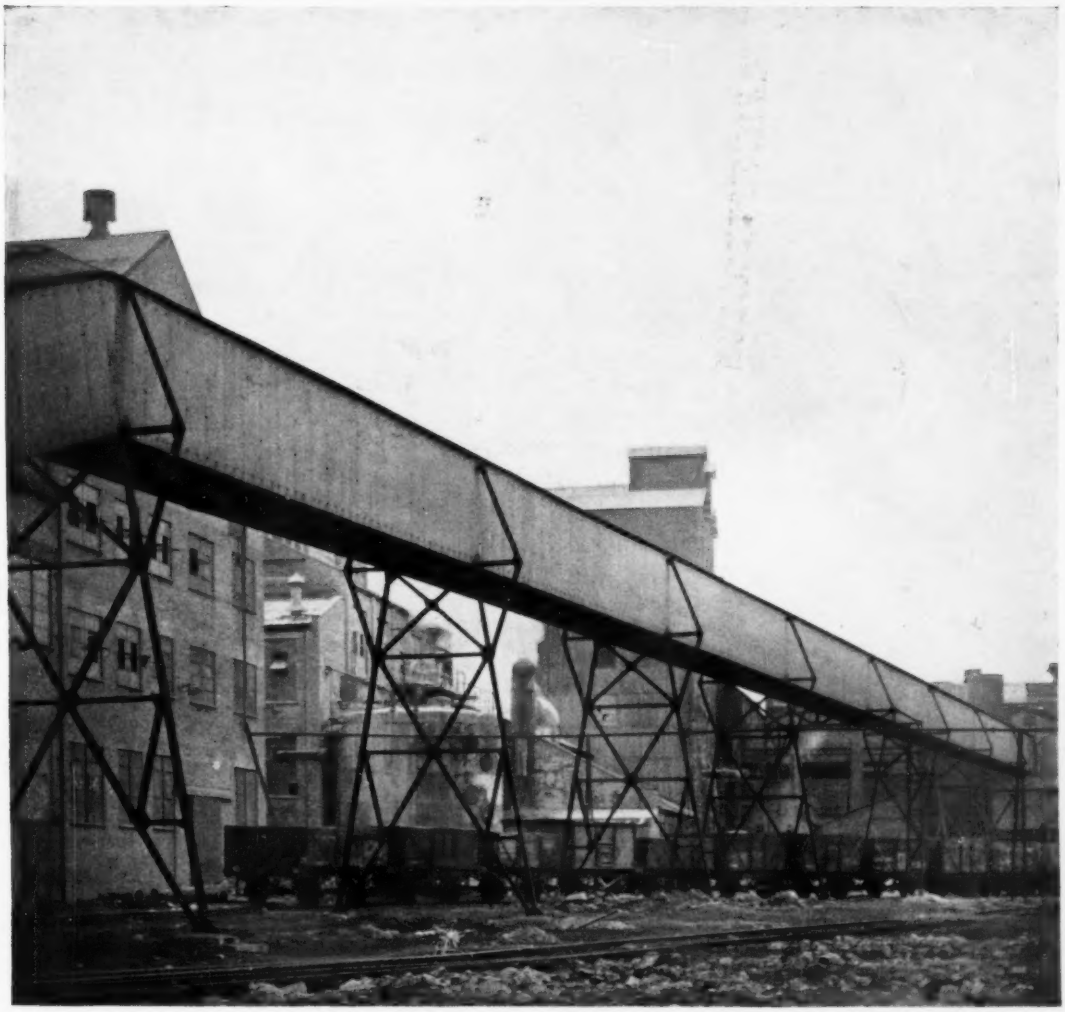

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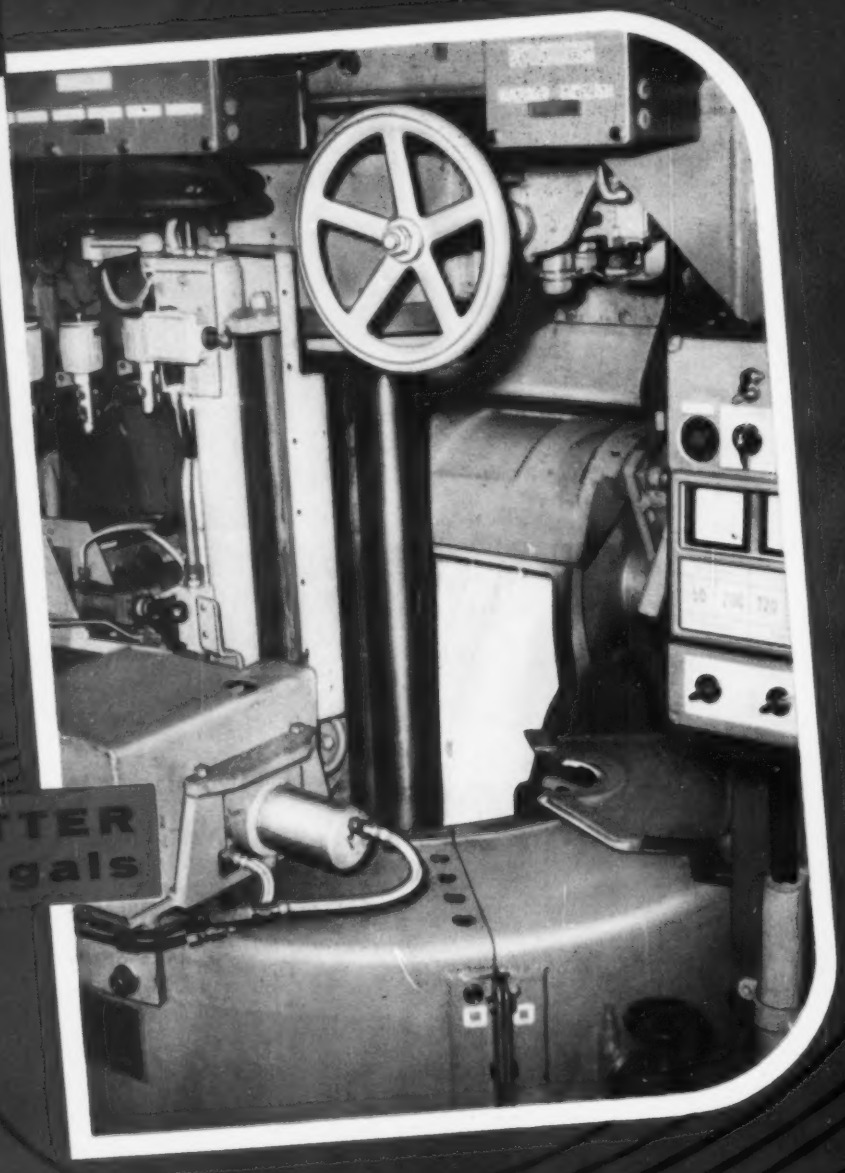

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Brazil	11/3,500	2,880,000
British Guiana	25/300,000	300,000
British East Africa	1/25,000	145,000
British West Indies	4/52,250	580,000
Ceylon	2/36,800	45,000
Dominican Republic	6/188,000	890,000
Egypt	1/108,500	300,000
Fiji Islands	12/102,000	192,000
India	114/504,110	2,275,000
Mexico	1/30,000	1,500,000
Mauritius	2/35,400	520,000
Pakistan	27/111,500	210,000
Philippines	11/88,550	1,150,000
South Africa	3/87,000	990,000
Spain	1/11,400	26,000
Venezuela	3/30,200	205,000
TOTAL:	279/2,391,810	14,448,000

ESTIMATED WORLD CANE SUGAR PRODUCTION 28,000,000 tons

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1	2 668	14.46	14.26	0.33	15.9	0.10	111
2	2 847	14.63	14.47	0.31	16.2	0.09	111
3	2 890	14.75	14.65	0.35	16.7	0.10	110
4	2 894	14.69	14.00	0.36	17.7	0.09	115
5	3 104	15.54	14.26	0.41	19.2	0.10	120
6	3 032	15.63	14.69	0.42	17.6	0.11	117
7	3 060	15.41	14.63	0.42	18.0	0.11	116
8	3 225	15.03	14.44	0.48	16.7	0.13	114
9	3 104	14.67	14.38	0.44	16.4	0.13	111
10	3 272	15.07	14.48	0.44	16.5	0.12	114
11	2 833	15.19	14.70	0.37	15.9	0.11	115
Average	2 994	15.01	14.44	0.39	17.0	0.11	114

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International Sugar Journal

VOL 63 *October, 1961* No. 754

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Published by
The International Sugar Journal Ltd.
Central Chambers, The Broadway,
London, W.5.
Telephone : EALing 1535
Cable : Sugaphilos, London.

* * *

Annual Subscription: 32s 0d or $5.00 post free
Single Copies: 2s 6d or 45 cents post free

PAGE

Notes and Comments 293
International Sugar Conference. Colonial Sugar Refining Co. Ltd., 1960/61 Report. Fiji Sugar Inquiry Commission Report. U.S. sugar legislation. Sir J. L. Hulett & Sons Ltd. Annual Report, 1960/61.

* * *

Agricultural Articles :

A Research Background for Recommendations for Sugar Cane Fertilization Part (IV) 295
By L. D. Baver.

Sugar Cane Breeding at Coimbatore 297

Striate Mosaic: A New Disease of Sugar Cane 298
By C. G. Hughes.

Sugar Cane Agriculture in Mauritius 299

Agricultural Abstracts 297, 299

* * *

General Articles :

The New Domino Sugar Refinery (Part II) .. 300

Evaluation of a De Smet Diffusion Unit 303
(Part III)
By F. Schneider, E. Reinefeld and H. P. Hoffmann-Walbeck.

The Production of Bottlers' Sugar, using a Rapid Polarographic Test for Assessing Suitability 306
By D. Hibbert, T. Langhan, W. Walker and G. Wilson.

* * *

Sugar-House Practice 311
Processing of sugar manufacture affected by cane trash. Improving filtration efficiency in (the) carbonatation process. A preliminary pilot plant experiment on the use of (the) Schumacher porcelain filter *etc.*

Beet Factory Notes 314
Ion exchange process for beet sugar refining. I. Purification of beet diffusion juice. II. Purification of sugar solutions. Optimum heat utilization in the sugar industry *etc.*

New Books and Bulletins 316
Centre Technique de la Canne et du Sucre de la Martinique, 1960 results. Fascicule I. Varieties. Approach to Europe. FAO Commodity Review 1961. Trends and forces of world sugar consumption *etc.*

Laboratory Methods and Chemical Reports 317
The cane analysis investigation. Preparation of melibiase-invertase for sugar beet molasses assay of raffinose. Changes in the concentration of amino acids in sugar beet plants induced by virus yellows *etc.*

By-Products 320
Glycerol production: a pilot-plant investigation for continuous fermentation and recovery. Operation of a bagasse fibre plant at Central El Palmar *etc.*

Patents 321
(Automatic ploughing mechanism for) Centrifugals. Glutamic acid solution from beet sugar waste. Beet harvester. Beet topper. Purification of sugar juices *etc.*

Greece Sugar Imports, 1958-60 323

Stock Exchange Quotations 324

Brevities 323–324

Index to Advertisers liv

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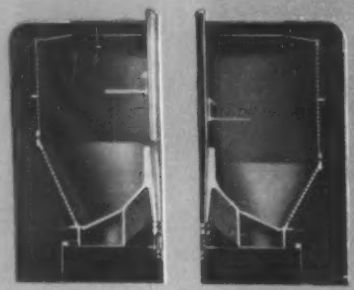

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THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXIII OCTOBER, 1961 No. 754

NOTES AND COMMENTS

International Sugar Conference.

The International Sugar Conference of the United Nations, called to review export quotas and prices under the five-year 1958 Agreement, opened in Geneva on the 12th September. Delegates from 44 countries are attending, and the Conference is expected to continue to mid-October. At the time of writing, opening addresses had been made by the representatives of Australia, the United Kingdom and Cuba. A number of committees has been established which are to study and recommend changes which should be made. Ireland has given notice that it intends to change its status from importer to exporter.

* * *

Colonial Sugar Refining Co. Ltd., 1960/61 Report.

Raw Sugar Milling.—Production of raw sugar at the Company's mills in Australia and Fiji during the 1960 season was 448,000 tons compared with 572,300 tons the previous season. This was produced as follows: 60,400 tons in N.S.W. (67,900 in 1959); 240,500 tons in Queensland (221,400) and 147,100 tons in Fiji (283,000).

The overall tonnage of sugar made at the Company's Australian mills in 1960 was the second highest on record, despite a reduction in New South Wales owing to drought.

A heavy loss was sustained in Fiji in the last financial year, brought about by a late start in harvesting and crushing, an inadequate weekly supply of cane from growers for a time after the start, the low quality of the cane, the use for this one further season of the old cane price scale which paid too high a price to the growers, and production at only 74% of the normal level.

The low production of 147,100 tons of sugar in the 1960 season was due primarily to a disagreement with the cane growers' associations about the terms and conditions of a new contract for the sale and purchase of cane, which had been unresolved since the previous year. An interim agreement for the 1960 season was eventually reached with a majority of the associations, using the old cane price scale. However, harvesting of the cane did not get into full swing until September, three months later than usual. At the close of the season, late in January 1961, a large proportion of the crop had not been harvested and crushed.

This serious disruption in the Fiji sugar industry led to the appointment by the Fiji Government of a Commission of Inquiry under the chairmanship of Sir MALCOLM TRUSTRAM EVE, Bt., G.B.E. The Commission began its work in Fiji during February of this year and ended its public hearings in March. Sir MALCOLM EVE and Mr. C. J. M. BENNETT, the accountant member of the Commission, subsequently came to Sydney for further investigations, including examination of the Company's Fiji accounts. The report of the Commission is referred to below.

Before the Commission left Fiji, representatives of the growers' associations and the Company, with the help of Sir MALCOLM EVE, made an *ad hoc* contract for one season covering the 1961 crop. The price payable for cane under this contract will be in accordance with the recommendations in the report by the Commission.

As very little planting was done in 1960 for the 1961 harvest season, the crop now being harvested consists in large measure of cane standing over unharvested from the previous season. The quality of the cane is therefore likely to be lower than normal, but it is hoped that sugar production will reach 195,000 tons which is not far below the normal level of output.

Sugar Refining.—Sales of sugar products from the five Australian refineries were 509,000 tons for the year ended March 1961, a decline of 3% on the previous year's sales. Sales were high in the previous year owing mainly to rumours circulating during the first quarter of 1960 of an imminent rise in the price of sugar which took place in May 1960. Many manufacturers and wholesalers built up sugar stocks, and thus inflated sales in the year ended March 1960, at the expense of sales in the year ended March 1961. A small fruit crop also contributed to the reduction in 1961 sales.

Sales of liquid sugar and bulk granulated sugar increased satisfactorily during the year, rising to 20% of total sales to manufacturers.

Sales of sugar products during the year ended March 1961 by a subsidiary, the New Zealand Sugar Co. Ltd., were a record: 115,600 tons were sold, an increase of 2% over 1960.

* * *

Fiji Sugar Inquiry Commission Report.

The report, published on the 6th September, gives details of the Fiji sugar industry and the dispute which came to a head in 1960. All parties—the Governments in London and Fiji, the C.S.R. Co. Ltd. and the cane growers—are censured for their parts in the affair. "We cannot see that the quarrels have gained anybody anything." It is proposed that Fiji should be allowed to export 50,000 tons more sugar to the U.K. per year; this would give the greatest single benefit to the sugar industry and the economy of the whole of Fiji. Independent help and guidance is needed; it is proposed that an independent chairman of the industry, resident in Fiji, be appointed immediately, together with the setting-up of a sugar advisory council to discuss problems and try to solve difficulties. It is hoped that this would be able to settle disputes, although there should be an ordinance providing that "no dispute shall be deemed to have arisen until the independent chairman certifies that he has tried to get an agreement between the parties concerned and failed." Until that certificate has been given it should be a statutory offence to do anything which would hinder orderly planting or growing of the cane, transporting of cane to the mill, or transport or storing or sugar. The dispute should then pass to the Chief Justice to select persons not resident in Fiji to decide the dispute. Recommendations are also made with respect to setting up an executive and statutory Sugar Board, that the Sugar Price Stabilization Fund levy be suspended, that the basis for molasses evaluation be changed, and a new cane contract is presented in draft form, together with other proposals.

* * *

U.S. sugar legislation.

In an article by T. SZULE in the *New York Times* of the 9th August 1961 it is stated that the Administration is preparing to ask Congress to approve next year a new Sugar Act eliminating the 27-year old system of individual quotas for foreign producing countries . . . "To replace the system that is now generally considered to be obsolete and economically and politically harmful to United States interests, the Administration is thinking along the lines of setting up a 'global' import quota open competitively to all the producers. . . . (The only exception is the Philippines which, under a treaty arrangement, is guaranteed a quota of 960,000 tons a year, which cannot be touched. . . .)

"To continue the protection of the domestic sugar industry, which cannot produce as cheaply as the foreign suppliers, the new plan would provide for the maintenance, through a new device, of the price differential between the United States and world markets. Thus, instead of paying the premium—which averages more than 2 cents a pound—directly to the foreign producers, the United States Treasury would collect it and place it into a fund to help underdeveloped countries. In 1959, these premium payments amounted to nearly $170,000,000 of which $153,000,000 went to Cuba.

"The present Sugar Act expires on the 30th June 1962 and the Administration expects to present its proposed legislation when Congress reconvenes in January. Studies now under way aim at working out a comprehensive formula regulating not only the import aspects of the new Sugar Act but also the feature affecting the domestic industry.

* * *

Sir J. L. Hulett & Sons Ltd. Annual Report, 1960/61.

Restriction of South African sugar production resulted in the limitation of the 1960/61 sugar crop to 327,009 tons, as far as the Hulett Group was concerned. The production quota for 1961/62 is 344,500 tons, as against an available crop of 520,000 tons. The South African price increase for sugar has done little more than to restore the 1958/59 profit margins and is considered substantially less than necessary for sound economy in the industry. Mhlume (Swaziland) Sugar Co. Ltd. produced 43,167 tons of sugar in its first full year of operations while Triangle Ltd. in Southern Rhodesia increased its output to 21,439 tons. Large scale alterations and extensions costing R400,000 (£200,000) have been carried out at Empangeni mill in order to modernise the boiler plant and increase factory output. Total melt at the Rossburgh refinery was 293,023 tons, or 11,348 tons less than in 1959/60.

Ngoye Paper Mills (Pty.) Ltd. enjoyed another good year, with an output of 28,444 tons of paper, compared with 21,991 tons in 1960. Of this 3252 tons were exported. The Ngoye subsidiary is the subject of a special section in the report, illustrated with colour photographs. Bagasse is taken by mechanical conveyor direct from the Felixton sugar factory to a point where it is transferred to a wooden launder. It floats down a special preservative solution and then dumped in a heap on a large concrete platform. This is a cheap technique and also eliminates fire hazard from spontaneous or external causes.

Market research had established the existence of a local demand for fluting paper used to make corrugated boxes, at the time of investigation (1951) this being imported from the U.S.A. Production started in 1953, using a paper machine bought second-hand from a European paper manufacturer. By 1954 demand was such that a major expansion programme was needed, and new dryers, paper machine and additional plant were installed. This doubled production but a further group of dryers had to be added in August 1956. Production has increased reaching the record quoted above. It has been decided to established another semi-chemical fluting paper mill at Piet Retief in the Transvaal; work on this mill is well advanced and it is expected to be in operation about July 1962.

A RESEARCH BACKGROUND FOR RECOMMENDATIONS FOR SUGAR CANE FERTILIZATION

By L. D. BAVER
(Director, Experiment Station, H.S.P.A.)

PART IV

Plant Composition as an Index of Fertilization

The comprehensive experiments, which have produced the large amount of data that have been the basis of these discussions, had as one of the major objectives the clarification of existing differences of opinion within the Hawaiian sugar industry with respect to the use of plant and soil analyses for fertilizer recommendations. Let us now analyse as objectively as possible the significance of the preceding data as a basis for evaluating the fertilizer needs of a given crop. Before entering into such an analysis, however, it is necessary to keep at least two important points in mind. First, no method of plant or soil analysis is absolutely perfect and exceptions to any established composition value will always occur. Second, a chemical analysis of either plant or soil, or both, is no substitute for good agriculture in the production of any crop, including sugar cane. Consequently, soil and plant analyses are only guideposts on the road of good fertilizer practices and not the road itself.

Comparison of Plant Tissues

Essentially, the major discussion centres around the relative advantages and disadvantages of stalk (8–10 internodes) versus leaf and leaf-sheath tissues.

Plant Nitrogen.—The data from this investigation have shown a fairly satisfactory correlation between 8–10 N and leaf N at six to eight months of age. Nevertheless, 8–10 N appears to have the following points in its favour as a logging tissue for long-crop cane:

1. The N-decay curve with time is more uniform and less fluctuating.

2. The sensitivity to nitrogen fertilization is much higher at all levels of nitrogen. Leaf N registered significant responses only at deficiency levels of N.

3. The correlation between yield and N composition is slightly higher with a more distinct yield distribution pattern.

4. The correlation between yield response as related to the N composition of unfertilized plants is significantly higher. The scatter of the response data for leaf N is quite large.

5. Nitrogen can be determined upon the same samples as other necessary constituents.

6. There is no necessity for applying correction factors.

The use of leaf N does have at least two major advantages which are primarily operational and not chemical. They are:

1. By using the leaf punch technique, sampling the leaves is much easier than sampling the stalk. Moreover, the stalk is not destroyed. This advantage, which is quite important if one is interested only in nitrogen, disappears when one has to sample other tissues for other constituents.

2. Leaf samples can be obtained at an age earlier than six months if it is necessary to have earlier samples in a logging procedure.

Plant Potassium.—Although the 8–10 K is slightly more sensitive than sheath K for reflecting potash fertilizer applications, the high correlation coefficient of 0·917 between the two values suggests that both are reliable indexes of the K composition of the plant. The advantages of the 8–10 K over sheath K-index is that it is determined on the same tissue as nitrogen and other constituents, whereas the latter is based upon a sugar-free tissue, thereby requiring a sugar analysis.

Plant Phosphorus.—The lack of correlation of sheath P with stalk P, with available soil P and with yield responses (other experimental data) makes the 8–10 P a much superior tissue for logging purposes. Moreover, 8–10 P is determined upon the same sample as other constituents and requires no correction factors.

Plant Moisture.—The similar behaviour of sheath M and 8–10 M with age (Fig. 5) would indicate that either of these values might be used for logging procedures. However, the correlation between 8–10 M and sheath M is only fair. Moreover, the smaller range of sheath M when compared with 8–10 M throws some doubt upon the sensitivity of the former. The 8–10 M has the advantage of being determined upon the same tissue as N and other constituents.

Plant Total Sugars.—In this study, stalk plant sugars were determined to check on their behaviour under various conditions and not to serve as logging indexes. The data have shown that the 8–10 TS are considerably higher than sheath TS, as should be expected. They also indicate that there is a general increase in 8–10 TS with age with only a slight variation in sheath TS.

Procedure for using Soil and Stalk Analyses for Evaluating Fertilizer Needs of Cane

It is recognized that fertilizer practices will vary from plantation to plantation, depending upon

local factors and management desires. However, inasmuch as the bulk of experimental evidence, both old and recent, indicates the superiority of applying fertilizers early in the life of the crop as compared with late applications, these procedures contemplate that the great majority of the fertilizer will be added at least by 8 to 10 months of age.

It is further recognized that the major value of both plant and soil analyses is to provide information on the relative deficiency or sufficiency of a nutrient, and not to serve as a mathematical device for calculating fertilizer applications. Consequently, analyses are restricted to plant moisture, plant nitrogen, soil and plant phosphorus and potassium. Suggestions concerning calcium are presented as a separate phase of the discussion. Total sugars are not determined since their value in helping to determine fertilizer programmes is extremely questionable.

Step 1. *Soil Analyses*

1. Obtain soil samples and determine available K and P (pH and available Ca may also be determined when necessary).

2. Plan K and P fertilization according to charts such as shown in Fig. 24 for potassium.

Step 2. *Nitrogen Fertilization*

1. Plan N fertilization for first six to eight months on basis of accumulated evidence from replicated field experiments as well as previous field practices for variety and location in question.

Step 3. *Plant Analyses*

1. Sample 8–10 internodes at 6, 8 and 10 months of age.

2. Determine 8–10 M, 8–10 N, 8–10 K and 8–10 P.

6-month sampling – Determine 8–10 M. If higher than 86, other determinations are unnecessary. If lower, check 8–10 N and K.

8-month sampling—Determine all four constituents.

10-month sampling—Check on 8–10 M, N and K.

3. Check the plant composition to determine the success of the fertilization programme in Steps 1 and 2 and to find out what additional amounts, if any, of N and K are necessary. The levels of M, N, K and P at these ages for varieties 37–1933 and 44–3098 should be somewhat as follows:

	$M(H_2O)$ %	N %	K %	P %
6 months	86–88	> 0·35	1·0	0·038–0·046
8 months	84–86	0·28–0·35	0·7–0·8	0·032–0·04
10 months	83–85	0·24–0·28	0·7–0·8	0·032–0·04

Step 4. *Applying Additional Fertilizer*

1. If deficiencies of N or K are observed, additional applications should be in the order of 75 to 100 lb of N or K_2O per acre. Smaller amounts will rarely affect plant composition. This additional amount of N added at this stage of development will rarely affect juice quality negatively.

2. In the case of P deficiencies, it is only under special conditions that surface application of P_2O_5 will be effective.

Calcium Determinations

Calcium becomes a limiting factor of growth only under acid soil conditions. In acid soil areas, the soil samples can be analyzed as follows:

1. Determine pH.

2. Determine available Ca on those soils where the pH value dictates, and evaluate Ca needs according to a chart similar to the one shown in Fig. 24 for potassium.

SUMMARY

Scientific investigations through new research tools, through new concepts arising out of the integration of ideas from a number of interrelated scientific disciplines, and through the objective analyses of the results of past studies in terms of present problems, are the basis of progress in all of man's endeavours. This is especially true in sugar cane production in Hawaii. It has been the purpose of this paper to review the developments that have taken place over the years in the search for practical means to guide plantation management in cane fertilization. More particularly, the value of tools that can be used as supplements to field experimentation has been discussed. Recommendations relative to the use of these tools have been made.

The results from these investigations along with other experimental data, as well as past and present experiences, warrant the following concluding statements:

1. Replicated field experiments are the best means for obtaining basic data for solving major fertilization problems. By obtaining supplemental information on soil and plant composition on these tests, the results of such experiments not only can be interpreted more easily but also can be extrapolated to other situations.

2. Unless soil and plant analysis techniques are based upon and correlated with field experimentation, they can often be misleading.

3. A successful programme of cane fertilization using tools supplementary to field experimentation will recognise the value of both soil and plant analyses and will include the contributions of both as guides in the exercising of good judgment for making fertilization decisions.

4. The differential behaviour of cane varieties with respect to the absorption and utilization of plant nutrients requires that the composition values of new varieties be established through adequate field experimentation.

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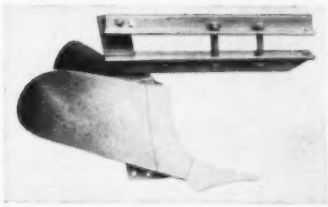

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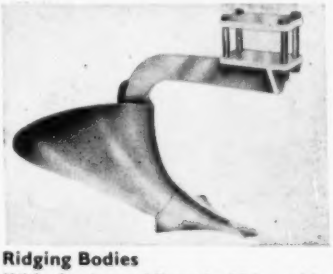

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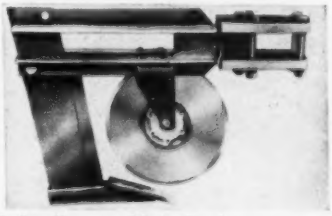

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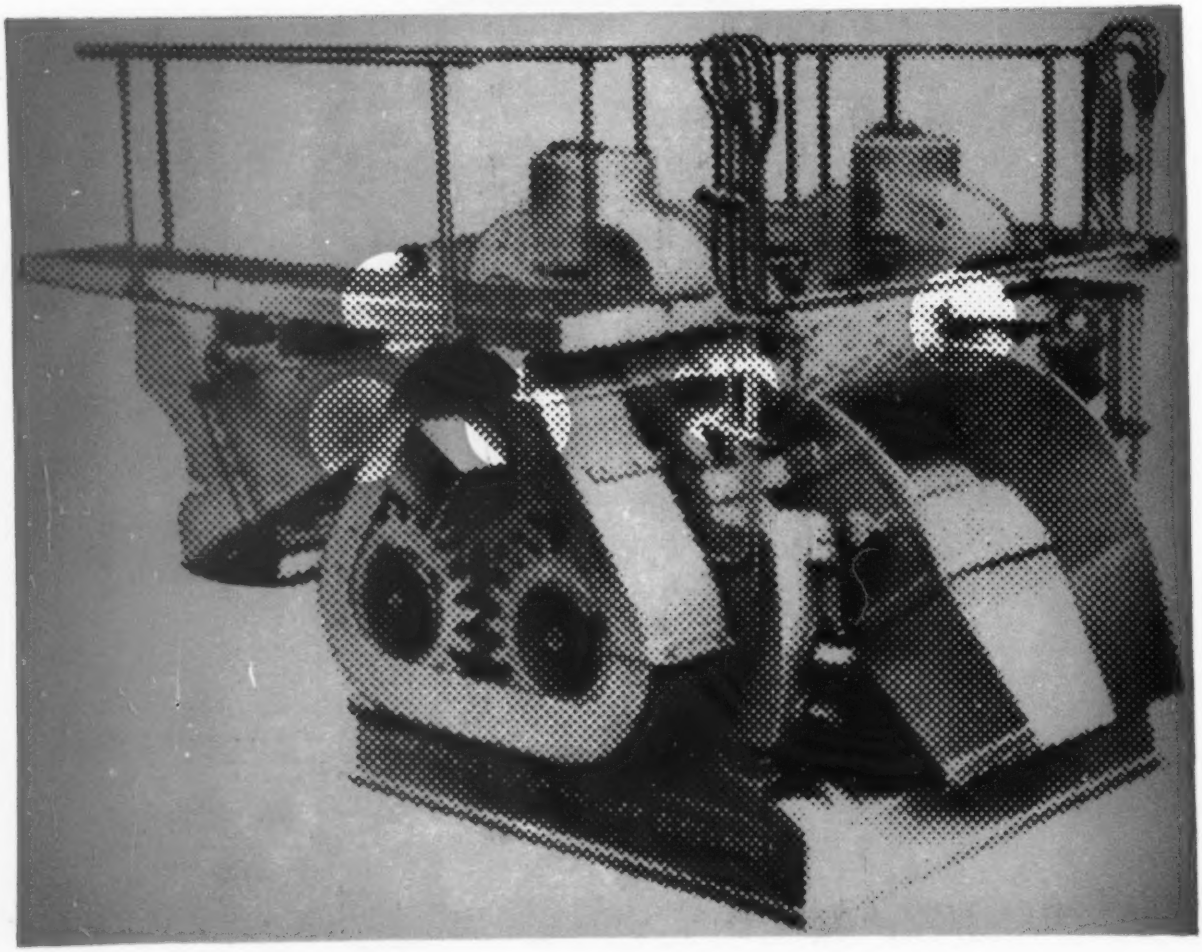

SUGAR CANE BREEDING AT COIMBATORE

Annual Reports of the Sugar Cane Breeding Institute for 1957/58 and 1958/59.

THESE two reports, received synchronously, are concerned with the progressive work undertaken with the ultimate objective of breeding new and more commercially-valuable varieties. Of necessity it involves a long-term programme and high lights are not to be expected. Only a general survey, therefore, is given of the activities covered by these reports.

Indian conditions vary widely and certain varieties have proved their worth under the conditions of the divergent tracts. The crossing of these varieties with those newer ones which show promise is an important feature of the programme which is extended to cover important foreign varieties; 65 crosses of the former and 51 of the latter group were made. Other crosses have been made for the specific purposes of securing resistance to diseases, pests, drought and waterlogging. Other genetical work includes inbreeding certain Co varieties and the inter-breeding of *S. spontaneum* variants.

It is not possible to recount here the details of these crosses and the subsequent seedling selection processes; the entire range is presented in extensive tables. The cumulative results of many years' work has resulted in the release during the period of 35 new varieties numbered consecutively Co 1274 to Co 1308.

In addition to the above, 111 crosses and selfs were made for specific cytogenetical studies including the linking of chromosomal constitution with such morphological characters as cane thickness, and with juice quality. A very wide parental range is included, yielding both intra- and inter- specific, and intergeneric crosses. In these, *S. officinarum* or *S. spontaneum* was used as pistillate parent.

Other cytogenetical work recorded includes the recovery from a cross between two *S. spontaneum* varieties with 2n = 40 and 64 respectively, of 3 seedlings of greater vigour than the rest and having chromosomes 2n = 52. Intergeneric crossing between *S. officinarum* or *S. robustum*, both lacking IV glume, with such other genera as *Sclerostachya* and *Erianthus* indicates the dominance of that character. Colchicine treatments were found to have no influence on chromosome numbers.

The Botanical section is largely concerned with the two collections of *S. spontaneum* variants and the World collection or germ plasm bank. In the former the variants fall into 3 groups: western with chromosome number (2n) 112–128, eastern 80–112 and central 40–80. Notes are given on many other aspects, e.g. morphological characteristics, the occurrence of starch, reactions to pests and diseases and inbreeding. Other studies include a search for the optimum conditions for use of SO_2 solution for preserving cane tassels, and experiments with gibberellic acid and irradiation.

Physiological studies dealt primarily with determinations on the effect of daylight control on flowering and the effect of such control on the N distribution—broadly, accumulation with increased darkness and diminution with increased light. Chemical studies covered the quality of cane seedlings and introduced commercial varieties, and maturity studies of cane planted at monthly intervals. A survey of factories on a basis of the various States was completed. A commencement was made of the analysis of sucrose and reducing sugars of cane pollen.

Mycological studies covered a number of diseases with emphasis on red rot, the approach being varietal resistance. In the case of red rot and smut the conditions for successful cultivation were investigated. The pest position was approached from points as presented by the different pests with the main objective of testing resistance, with its causes, both in *S. officinarum* and *S. spontaneum*. The latest report ends with a scheme for investigating seedling pests and their control, and a résumé of the work at the Karnal Sub-Station.

The entire reports are heavily documented with tables and diagrams.

H. M.-L.

AGRICULTURAL ABSTRACTS

Cuban canes of high productive capacity. R. C. BOURBAKIS. *Cubazúcar*, 1960, **5**, (9–12), 20–24.—Comparative lists in tabular form (yield of cane and sugar) are given covering 25 varieties grown at 7 Centrals for comparison with POJ 2878, in recent years "running out". The two Cuban canes C 693-47 and C 529-50 are indicated as the most promising.

* * *

Insecticidal control of termites attacking sugarcane. V. M. KALYANARAMAN, P. S. NARAYANASWAMY and A. L. DAVID. *Madras Agric. J.*, 1960, **47**, 166–171; through *Hort. Abs.*, 1961, **31**, 428.—Good control of *Odontotermes obesus* was obtained with "Aldrin," "Dieldrin" or "Heptachlor" mixed with the soil at 1 lb actual ingredient per acre prior to planting. "Heptachlor" is recommended because of its lower cost.

* * *

Fiji disease. M. LAUFFENBURGER. *Rev. Agric.* (Réunion), 1960, **60**, 243–247.—The article reviews the steps taken to control and, it is hoped, to eliminate the disease from the island, an important feature of which is the control of the varieties cultivated.

STRIATE MOSAIC : A NEW DISEASE OF SUGAR CANE

By C. G. HUGHES

Bureau of Sugar Experiment Stations, Brisbane, Queensland.

THE term "striate mosaic" is proposed for a new disease of sugar cane which, although suspected as a disease since 1956, has only recently been transmitted by an inoculation technique. The disease is so far confined to the Lower Burdekin district in North Queensland, where it has been found only in the varieties Pindar and Q 57. A search for it has been made in other districts, especially on the Herbert River where Pindar produces more than 750,000 tons of cane, but without success.

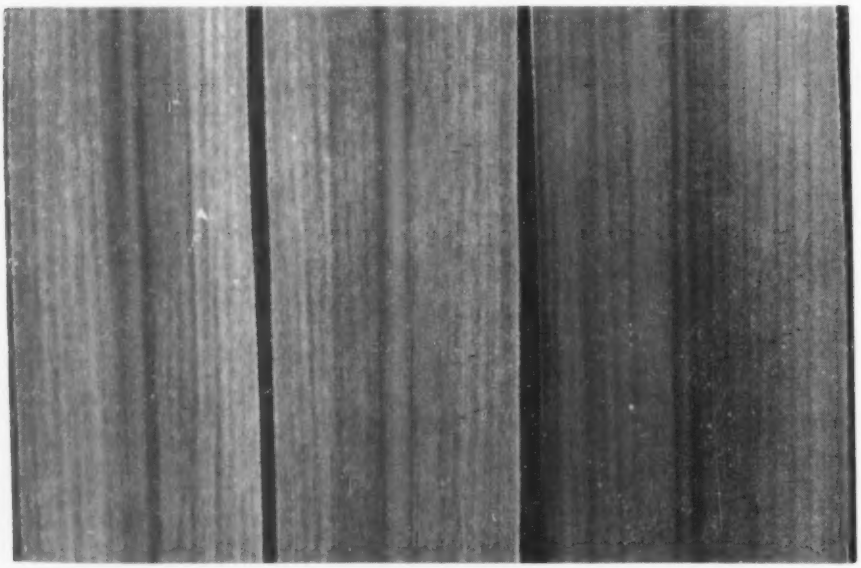

Fig. 1.—The fine striations of striate mosaic are diagnostic of the disease. Healthy leaf on right.

Symptoms.—The most obvious diagnostic feature of the disease is seen in the short, fine striations on the leaves (see Fig. 1). These can just be separated by the naked eye and vary in number from a comparative few to such large numbers that the greater part of the leaf blade is covered with them. They are a lighter colour than the normal blade and show first on the younger exposed leaf. Their best development occurs as the leaf expands and they are difficult or impossible to find as it matures and ages. They occur less in the region of the larger vascular bundles than in the tissue between and so, in the aggregate, often give a marked striping effect on the younger leaves, or even a yellowing to the entire top. They can be found on the green lower surface of the mid-rib but cannot be distinguished on the top surface of the mid-rib nor on the leaf sheath. Infected stalks do not show any markings on the rind.

Fig. 2.—Severe crop losses may be caused by striate mosaic. *Left:* Diseased Pindar. *Right:* Healthy Pindar.

Severe stunting and loss of crop (Fig. 2) is usually associated with the striations but striations without stunting have been found in Pindar.

Transmission.—The disease is systemic and therefore is sett-transmitted. Heat treatment of the setts in water at 50°C for three hours or in air at 54°C for 16 hours, which is effective against ratoon stunting, failed to free them from the disease. Inoculations into healthy setts failed to obtain infection but needle-prick inoculation through a diseased leaf into the spindle in the manner described by SEIN[1] was successful. Transmission was obtained by this method for both the striations alone and for the striations plus stunting.

Causal Agent.—The fact that a virus inoculation technique will effect transmission and that no microscopic organism has been found associated with

[1] *J. Dept. Agric. Puerto Rico*, 1930, **14**, 49–68.

the disease, indicates that it is viral in origin. It would appear that two viruses may be involved, one of which produces the striations and the other the stunting.

Control.—The disease spreads slowly in the field and the use of disease-free planting material, which is readily available, should prevent it ever becoming a serious menace.

SUGAR CANE AGRICULTURE IN MAURITIUS

Sugar Congress, Mauritian Society of Agricultural and Sugar Technology, 1960[1].

IN a paper by G. MAZERY the latest developments in mechanisms employed in the transport of cane were described. The financial aspects are considered in some detail and cover the methods of payment and maintenance, and a detailed summary of these costs is given. The present status and future trends in chemical control were discussed by E. ROCHECOUSTE both in general terms and in reference to the more pernicious weeds, such as *Digitaria* and *Cynodon*.

The larger number of agricultural papers refer to diseases and pests. A very detailed account of the fight against Fiji disease—of especial interest to Mauritius in view of the possibility of infection across the Indian ocean—was given by G. LAUFFENBURGER of Madagascar and, in a second paper, P. BAUDIN notes the presence in Madagascar of new leaf-galls and discusses their etiology. Present information does not suggest any association with Fiji disease.

The reappearance of gummosis in Réunion after a lapse of 20 years and following the cyclone of 1958 was discussed by D. D'EMMEREZ DE CHARMOY who drew comparisons between the symptoms of the present and earlier attack. Varietal resistance is discussed in some detail. Chlorotic streak and its control by hot water or hot air treatment was dealt with by R. ANTOINE from the aspect of treatment technique.

Of the three methods mentioned as applicable to the control of *Perkinsellia saccharicida*, the vector of Fiji disease—insecticidal, rogueing and the growth of resistant varieties—the paper by B. SIGWALT is devoted mainly to the first two, with notes on the relative resistance of certain varieties.

The factors affecting the flowering of sugar cane and the use of methods by which they can be controlled were covered by a paper by E. F. GEORGE in which present information on the subject is summarized.

Of especial importance to Mauritius, owing to their frequency and the need for evaluating the damage done, is the question of cyclones and their incidence. The results of studies in this matter were recorded by E. G. DAVY. A further paper, by G. ROUILLARD, analyses the relative damage of the two cyclones, Alix and Carol, the latter on 28th February 1960. A paper by R. SENTENAC which describes surveys of the Northern areas by electrical resistance for the location of aquifers is of importance if the best use is to be made of the subterranean water supplies.

H. M.-L.

AGRICULTURAL ABSTRACTS

Variations in juice quality in top-borer-affected cane. H. DAVID and V. RANGANATHAN. *Madras Agric. J.*, 1960, **47**, 201–5; through *Hort. Abs.*, 1961, **31**, 428.—Studies were made on variation in juice quality from varieties Co 419, Co 449 and Co 527 attacked by *Scirpophaga nivella* as relating to variety and time of harvest. Varietal differences were not found, but canes attacked up to the ninth month were found to be of lower quality, whereas those affected later showed no deterioration. Top borer attack induced early maturity in full grown canes.

* * *

Weeds of Mauritius. VI. Argemone mexicana. E. ROCHECOUSTE and R. E. VAUGHAN. *Mauritius Sugar Ind. Res. Inst. Leaflet*, 1960, (4).—A detailed account of this pantropical weed of Mexican origin is given accompanied by good line drawings. Control may be effected by MCPA or 2,4-D applied at the rate of about 1½–2 lb a.e. per acre. A bacterial disease or wilt (*Xanthomonas papavericola*) sometimes checks the spread of the plant.

* * *

Accumulation and transformation of sugars in stalks of sugar cane. K. T. GLASZIOU. *Plant Physiology*, 1961, **36**, 175–179.—Reference is made to previous work by the same author on this subject in Queensland. In the present investigations the sugar cane variety Pindar was used throughout, tissue discs being cut from young internodes about five centimetres long. Methods of cutting and handling the tissues and isolating, identifying, and assaying radioactive sugars were the same as in previous work.

[1] *Rev. Agric. Sucr.* (Mauritius), 1960, **39**, 4-5.

THE NEW DOMINO SUGAR REFINERY

PART II

After phosphatation, the washed sugar liquor passes to retention drums where it is aerated. Subsequent passage through clarifiers removes solid calcium phosphate floc containing various impurities by flotation. Clear liquor is removed continuously from the bottom of the clarifiers. The liquor flow rate and temperature to the clarifiers are controlled within very narrow limits to ensure maximum efficiency in the clarification process.

The clarified liquor is filtered prior to decolorizing through vertical-leaf tank-type pressure filters. The filter station is almost completely automatic and is operated from a local control panel. The automatic portion of the filter cycle includes sweetening-off and sluicing of the filter cake, precoating and recycling to the cloudy liquor surge tank. The station operator's duties include initiating sweetening-off, as determined by the pressure in the filter, and the filtration part of the cycle, as determined by tank level indicators. The operator is also responsible for inspecting the filter effluent, after a period of recycling to the cloudy liquor tank, to determine when to turn it to the clear liquor tank. Diatomaceous earth is added in a liquor slurry to the cloudy liquor tank. The amount added is controlled by a flow ratio controller which receives its signal from a flow measuring device in the washed sugar liquor stream.

Sluiced press cake and the clarifier scums are combined, and the solids are separated for discard by rotary belt vacuum filters. The cake is given a final sweetening-off on the filter drums.

The clarified washed sugar liquor is de-aerated and then decolorized, using the highly efficient countercurrent Continuous Adsorption Process (CAP),[1] with bone char as the adsorbent. Three decolorizing columns, 12 feet in diameter and having bone char beds 40 feet deep are used. Unlike conventional stationary bed char cistern operation, both the bone char and the sugar liquor move. The sugar liquor moves upward in the columns at a uniform rate, while the bone char moves downward, also at a uniform rate. but much slower relative to the liquor. The maximum adsorptive capacity of the bone char is used since all adsorptive surfaces are in intimate contact with the sugar liquor across the entire cross-sectional area of the column at all times due to the very slightly expanded condition of the char bed. This bed condition also eliminates channelling and by-passing of the liquor. The true countercurrent nature of the operation automatically ensures that the bone char with the highest adsorptive capacity contacts the liquor with the lowest level of impurities, and partially exhausted bone char contacts the liquor with the highest level of impurities. The expanded bed plus the true countercurrent liquor-bone char contacting operation result in a low-colour product of uniform quality. No liquor blending is required and thus no liquor gallery is needed. Furthermore, the colour of the product liquor can be adjusted at will by simply adjusting the flow ratio of the bone char relative to that of the liquor.

Spent bone char slurried with liquor is removed continuously from the bottom of the decolorizing column, using the hydraulic head in the column as motive power. The bone char-liquor slurry is partially deliquored on a top-feed rotary vacuum deliquoring screen. The bone char and the remaining liquor drop through another, much smaller column (3 feet 6 inches diameter, 19 foot bed depth) where it is sweetened-off countercurrently and continuously by an upward flow of hot water. Sweetening-off is accomplished rapidly and efficiently, so that a high purity sweetwater of a relatively high and constant solids content is obtained, suitable for use directly in melting raw sugar. Very little adsorbed ash is removed during sweetening-off.

The sweetened-off bone char is run as a water slurry into the top of a single de-ashing column, of 3 ft 9 in diameter and having an operating bed about 19 ft deep, where soluble ash is removed countercurrently and continuously by an upward flow of warm water. Washed bone char is removed continuously from the de-ashing column in a water slurry. Since the sweetening-off and de-ashing operations are carried out in different columns, optimum water temperatures and flow rates can be used to ensure the production of a high purity sweetwater, and to maximize ash desorption.

After dewatering on a top-feed rotary vacuum dewatering screen, the wet bone char is reactivated in a multiple hearth kiln in a controlled oxygen atmosphere. Reactivated bone char is cooled, screened and conveyed back to the top of the decolorizing column.

The entire CAP system, including bone char reactivation is automatic and electrically interlocked, thus requiring only the part-time services of one operator.

A number of important savings and related advantages have been realized by the use of the CAP compared to a conventional char cistern system. Direct savings are:

(1) Over 50% in capital investment; (2) over 90% in operating costs; (3) over 50% in fuel costs for bone char reactivation; (4) over 75% reduction in bone char inventory; and (5) over 80% reduction of in-process liquor inventory.

Additional advantages in other areas of the refinery have been realized in: (1) reduced bone char usage; (2) improved product quality; (3) greater sugar extraction; (4) reduced recycling of liquors and sweetwater; (5) reduced quantity of remelt boiling; (6) easier refining of unusually difficult raw sugars; and (7) easier maintenance of good sanitation.

[1] U.S. Patent 2,954,305; *I.S.J.*, 1961, **63**, 28.

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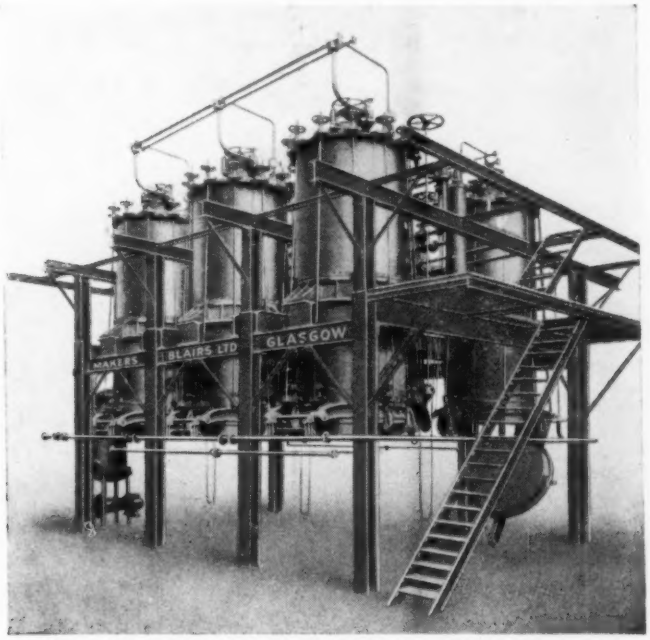

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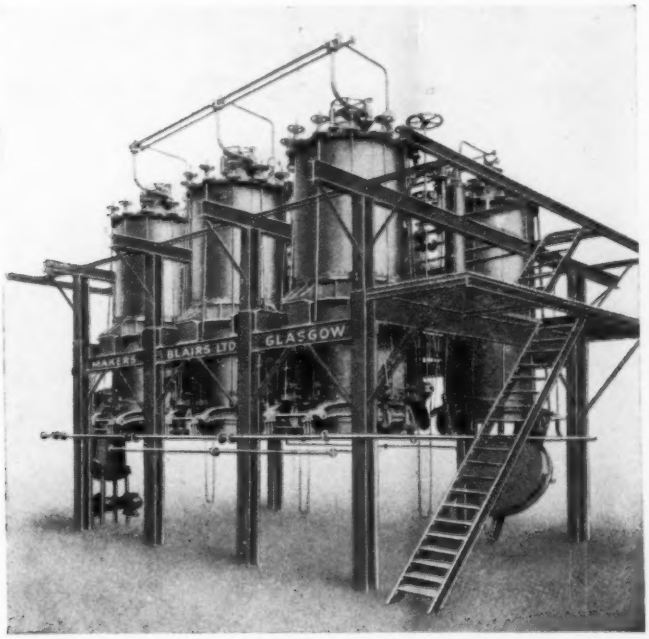

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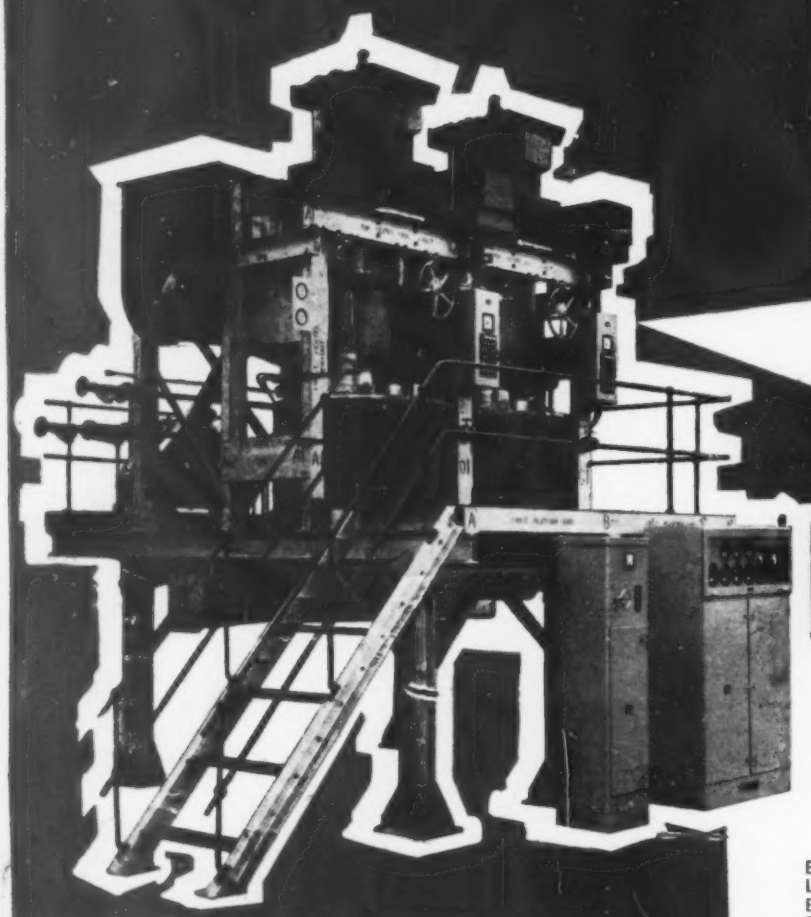

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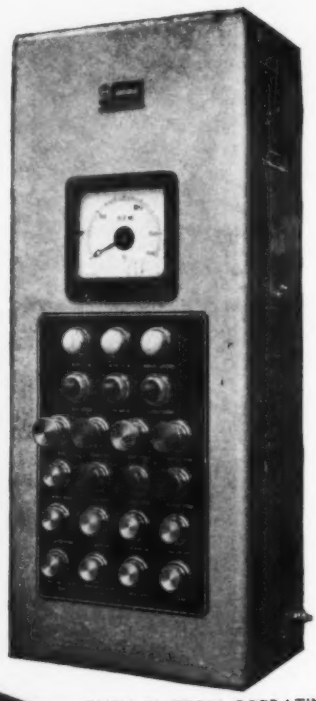

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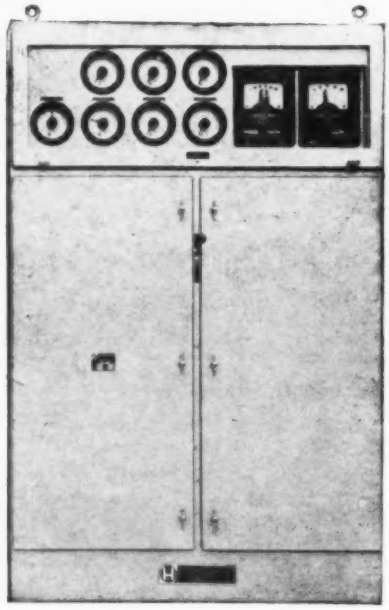

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The decolorized washed sugar liquor from the CAP system is polish-filtered in vertical-leaf tank-type pressure filters identical to and located in the same area as those used for clarified liquor filtering. As in the case of the clarified liquor filters, these filters are automatic and require little supervision. Diatomaceous earth addition is also accomplished automatically using a flow ratio controller.

The filtered decolorized liquor is concentrated in a single-effect falling-film evaporator prior to crystallization.

A three-strike granulated sugar boiling system is used. Full seeding, using a powdered sugar-liquor fondant, is practiced. The wash and green syrups from each strike are separated and the wash syrups are returned for re-boiling. By means of a controlled amount of inboiling, the purity of the No. 3 granulated green syrup is maintained at a sufficiently low level to allow this syrup to be sent directly to the remelt boiling operation.

Three 1400-cubic foot working capacity pans are used for granulated sugar boiling; one pan alternates between coarse grain sugars and No. 1 sugar, a second

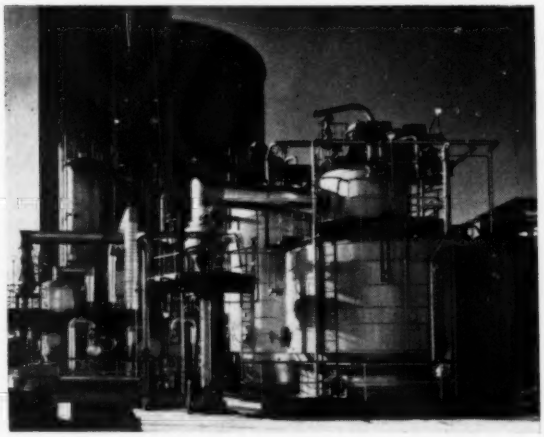


Fig. 6

pan boils only No. 1 sugars, and the third pan alternates between No. 2 and No. 3 sugars. All three pans are calandria type and have top-driven circulators. The pan design was developed by The American Sugar Refining Company after a comprehensive study of existing pan designs and considerable experimentation on new concepts of pan operation. This special design was oriented toward improving the efficiency of the boiling process, minimizing operating costs, and allowing for the complete automation of the boiling process.

A separate mixer and set of centrifugal machines is provided for each of the three grades of granulated sugar and for coarse grain sugar. The mixers are totally enclosed and are of different capacities depending on the frequency with which each receives strikes of sugar. All white sugar centrifugal machines are 48 in diameter, 1200 r.p.m., and are fully automatic.

Fig. 7

A three-strike boiling system using two 1100-cubic foot working capacity pans, is used for the production of remelt sugar. The impurities enter the system in the affination syrup and No. 3 granulated green syrup. High and intermediate remelt strikes are boiled from footings in order to produce a large grain, which, when mingled with affination syrup, will produce a magma suitable for affination. The high remelt strikes are boiled on fillmass footings made from No. 3 granulated green syrup. The intermediate remelt strikes are boiled on magma footings made by mingling unwashed final remelt sugar and high remelt green syrup. The final remelt sugar is boiled on a fondant seeded affination syrup charge and fed with intermediate green syrup. As in the case of the white sugar boiling system, the remelt boiling system is fully automatic, except for the transfer of footings.

A cylindrical mixer is provided for high remelt strikes. Three crystallizers, with automatically programmed cooling and reheating, are provided for curing final remelt strikes. A fourth crystallizer is used for curing intermediate remelt strikes.

Separate rotating drum granulators are provided for each grade of granulated sugar produced. Each drum is fitted with air and sugar temperature measuring and controlling devices. Filtered, heated air is used for drying. Wet dust collectors are used for recovery of sugar dust. The granulators discharge to

a vibrating conveyor which collects and blends the dry sugars and transports them to the classification screens. The coarse grain sugar granulator discharges to a separate conveyor. Provision is made for the separation of off-grade sugars to another conveyor for further processing.

The combined granulated sugars are conveyed to a single distribution hopper which feeds 6 vibrating screen units. In these machines, scalpings, Domino Fine Granulated and Domino Extra Fine Granulated fractions are separated and discharged by gravity to storage bins and silos. The throughput from the bottom sieve is further screened on two eccentric screening units to yield two additional fine grained granulated sugar fractions. Two eccentric screen units are provided for the screening of coarse grain sugars.

The various grades of granulated sugar are stored in silos and bins after screening.

Granulated sugar is packaged in 2 lb, 5 lb, 10 lb, 25 lb and 100 lb bags and in 2 lb cartons. Modern high speed packaging units are used for both bag and carton filling and sealing, and for bundle and container filling and sealing. Sanitation requirements played a large part in the design of the air conditioned packaging area. A pneumatic spillage collecting system is used to eliminate the accumulation of any spillage under the machines. Sugar fed to the various packaging lines from the storage bins and silos is automatically controlled from the refined sugar distribution panel.

Powdered sugar is produced by rotary hammer mills from granulated sugars. Discharge of the sugar from the mills is directly to the packaging machines.

All production is automatically palletized prior to package storing. The warehouse has sufficient capacity for the storage of over 10 million pounds of refined sugar. The warehouse was laid out on one floor to make storage and pick-up for delivery rapid and efficient.

Fig. 8

Both bulk and packaged sugars can be shipped by either rail or truck. Facilities are provided for indoor loading of rail cars, both for bulk sugar and for packaged sugar.

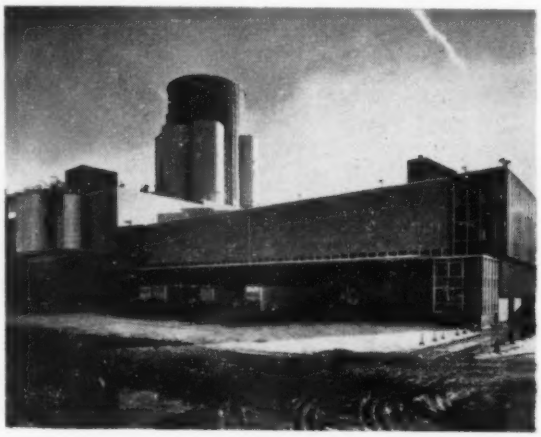


Fig. 9

Both invert and sucrose grades of liquid sugar are produced. Five 30,000 gallon storage tanks are provided for the blending and storage of liquid sugar. The liquid sugar shipping station is designed to maximize sanitary handling.

Steam for the plant is generated by three oil fired package boilers, each rated at 60,000 pounds of steam per hour. Steam is produced at 385 p.s.i.g. for the turbo-generator and is reduced to 150 p.s.i.g. for certain process work. The turbo generator exhaust (25 p.s.i.g.) is used for heating the vacuum pans and evaporator and for general process and space heating. A 7-pound flash steam system supplies heat to the granulators, to the affination syrup heater and to the liquor de-aerator.

Boiler controls include automatic combustion control, automatic oxygen analysis and smoke detection.

The boiler feed water is preheated to 190° F by heat reclamation from process streams.

Following the objective of low construction cost, only the firing aisle of the boilers is located inside the boiler house, the boilers themselves being located outdoors.

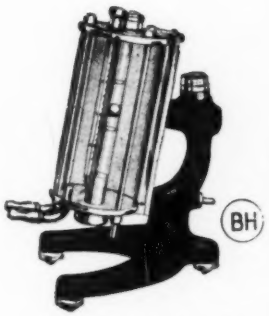
All electricity normally used in the refinery is produced by the steam-driven turbo-generator.

In keeping with the design of the plant, a modern, well equipped air conditioned laboratory is housed in the refining process section of the Refining Centre. The laboratory is centrally located to be readily accessible from any part of the refining process and from the packaging and shipping areas as well as the liquid sugar shipping area.

Laboratory facilities include provisions for microbiological test work as well as the routine chemical test normally performed in a refinery laboratory.

Suma Products

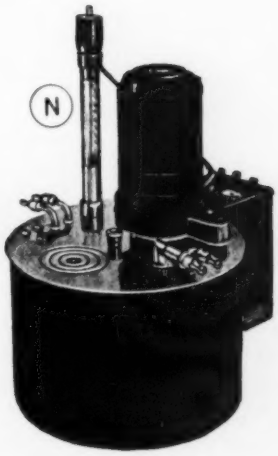
VISCOSITY MEASUREMENT



For the study of viscosities of sugar-house products, the **HÖPPLER VISCOMETER (Type BH)** is both accurate and rapid in operation. This instrument has a range of 10 to 1 million c.p. with an accuracy to within ±0.5% of the true value. There is no error due to surface tension, evaporation, skin formation or retention of fluid residues within the measuring chamber. It operates from —60°C to 150°C, is electrically heated and suitable for 100/110 V. or 200/250 V. A.C., 50 or 60 cycles.

Thermometer Ranges. **0·1°C. subdivisions :** —1 to 26°, 24 to 51°, 49 to 76°, 74 to 101°C.
0·5°C. subdivisions : —1 to 55°, 50 to 100°, 100 to 150°C.

For the supply of a constant-temperature source of water to the Höppler Viscometer Type BH, as well as to instruments such as refractometers, etc., the Ultra thermostat (Type N) may be used with advantage. The content of the tank is 7 litres and the temperature control can be regulated to within ±0.01°C. It is fitted with an efficient self-starting squirrel cage motor (or Universal motor, if required) and is quiet in operation. Three heating stages are available (500, 700 and 1200 watts) so that only a short heating-up period is required. The thermostat is suitable for voltages of 110 or 220, 50 or 60 cycles, single-phase alternating current.



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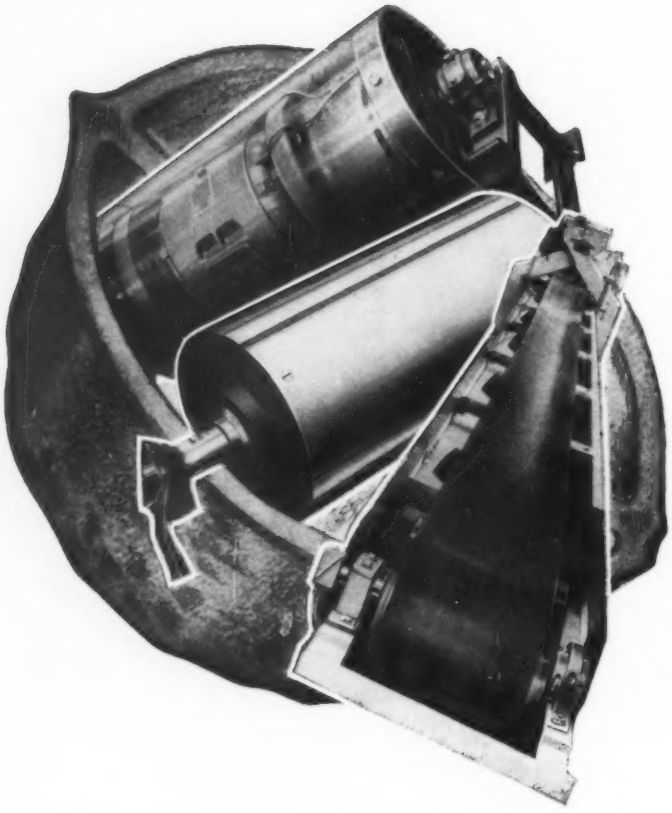

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The construction of the new highly automatic Domino refinery in Boston has been accomplished at low cost consistent with the criteria of high product quality and maximum sanitation. Operating costs have been minimized. Several new approaches to the refining of sugar have been proven in practice. In particular, a new Continuous Adsorption Process for decolorizing sugar liquors has been shown to be a gateway to the future for the sugar refiner.

EVALUATION OF A DE SMET DIFFUSION UNIT

By F. SCHNEIDER, E. REINEFELD and H. P. HOFFMANN-WALBECK
(Sugar Institute, Technische Hochschule, Braunschweig)

PART III

Cossette Quality

To characterize the juice extraction performance of a diffuser we must also know something of the cossettes being processed as well as the mechanical stresses on the cossette during extraction. In the case under consideration we examined:

fresh cossettes: the Silin number
the Swedish number[4]
the mush content (cossette particles of < 1 cm)

Exhausted cossettes: the mush content
the Swedish number

The results are given in Table 5.

Table 5

Cossette quality (average values)

		Range of fluctuations
Fresh cossettes:		
mush content	5·5%	4–8%
Swedish number	9·2	5–11
Length/100 g	14·1 m	—
Exhausted cossettes:		
mush content	7·8%	6–11%
Swedish number	5·7	2–10

The untreated cossettes had a length of 14 m/100 g, were fairly fine and of average quality. Up to discharge of the exhausted cossettes, the mush content increased by only 2%, and the Swedish number was always about 6. These values show that the cossettes undergo no great mechanical stress when treated in the De Smet diffuser. It is to be expected that the cossettes will undergo no further movement after the blanket has been formed and that a fairly firm cossette mat will be processed. Accordingly, the raw juice contains practically no fines removed by friction. The very small amount of mechanical stress indicated by the data will occur basically in the separator and in the "scalding zone" (cossette blanket depth control), and through the pressure rollers.

Microbiological Tests

In the microbiological investigations counts were taken of the mesophiles (27°C), thermophiles (55°C) and ultrathermophiles (65°C) in the samples withdrawn. The ultrathermophiles can cause metabolism in Central European factories up to about 77°C and thus still cause sugar losses in diffusers maintained at those temperatures. The bacterial activity was also determined by adjustment of the samples of 5°Bx by adding sterile water or sterilized raw juice, titration with N/56 NaOH against phenophthalein or to pH 8·2 using a glass electrode and 5 hr incubation at approximately the average diffusion temperature; bacterial activity = increase in acidity.

The results of microbiological tests are given in Table 6.

(*a*) *fresh cossettes:* the microbiological conditions in a juice extraction plant are to a great extent dependent on the number of micro-organisms in the fresh cossettes. At the time of the test the beet were delivered with a large amount of soil and leaves. Therefore, the cleanliness, despite three beet washers arranged one after the other, still left something to be desired and a large number of bacteria were found in the fresh cossettes especially those with an outer skin (Nos 1 and 2).

(*b*) *fresh water:* River water was used as fresh water for diffusion. The bacterial counts of thermophiles and ultrathermophiles, which are particularly injurious to diffusion plants, were exceptionally low (No. 3). To acidify the normally slightly alkaline river water, some SO_2 was added (a total of about 500 kg in 21 days). Of course, this small quantity of SO_2 did not have any sterilizing effect.

(*c*) *press-water:* the press-water used in the return cycle had a high degree of infection because of the low temperatures and long pipelines. Before reheating, the press-water was strongly, but only intermittently, chlorinated. The bacterial counts after the heater varied according to whether the samples

[4] Bjerkhög: *Socker Handl.*, 1948, **4**, 97.

in any one period were taken with (No. 4) or without (No. 4a) chlorination. The bacterial activity in non-chlorinated press-water was low despite high bacterial counts. This may perhaps be explained by the fact that a certain intermixing of chlorinated and non-chlorinated press-water has taken place in the press-water tank. The bacteria were still not completely killed, but their metabolic action was considerably inhibited.

(*d*) *juice extraction plant:* the bacterial activity was countered by adding 55 litres of formalin every 8 hr. Thus 40 litres (in portions of 10 litres) were added to the diffuser itself at four different points, 5 litres to the raw juice pulp trap and 10 litres to the press-water. The samples from the diffuser were taken from the 18 sampling points and from the inside of the diffuser through the sight glass apertures. A guide check revealed an approximate straight line pH curve for the juice samples from the diffuser, indicating no increase in infection (see Fig. 6).

At the water end, especially at sampling point 1, there was nevertheless quite a high bacterial count for thermophiles and ultrathermophiles (Nos. 5–5b). Apparently the development of the micro-organisms at this point was favoured by low temperatures. The infection at the water end did not spread, however, to the rest of the diffuser; at sampling point 2 a considerably reduced bacterial count was found. Thus similar values were obtained with the juice samples from this point (No. 6) and from the inside of the diffuser (6a), an indication of the apparent absence of bacterial colonies in the juice lines leading to the sampling cocks.

At sampling point 3 a comparatively high number of ultrathermophiles was discovered in a random test (No. 7). This may be due to the fact that press-water, of varying degrees of infection, is added at this point. Towards the middle of the diffuser (Nos. 8–11a) the bacterial counts were still very low, and with one exception (11) there was no bacterial activity. At the cossette end of the diffuser there was a slight increase in the bacterial activity (12–13a). In one case (13a) a somewhat higher number of thermophiles was also found.

Table 6

Microbiological tests

No.	Sampling point	Temp., °C	pH	Bacterial activity (acidity increase) after 5 hr at 65°C mg % CaO	Bacterial counts/ml Meso-philes (27°C)	Thermo-philes (55°C)	Ultra-thermo-philes (65°C)
1.	Fresh cossettes (with outer skin)	—	—	–	$14{\cdot}5 \times 10^6$§§	1,800§§	200§§
2.	Fresh cossettes (middle sections)	—	—	–	$8{\cdot}0 \times 10^6$§§	200§§	50§§
3.	Fresh water	7·5	6·2	0	3,000	15	<1
4.	Press-water after heater (without chlorination)	62	5·5	2	—	120,000	2,100
4a.	Press-water after heater (with chlorination)	68	5·9	0	—	600	100
	De Smet Diffuser :						
5.	Cock 1 (water end)	50	6·3	8	—	130,000	10,000
5a.	Cock 1 (water end)	60	6·9	9	—	12,700	1,100
5b.	Cock 1 (water end)	58	6·6	6	—	64,000	2,500
6.	Cock 2	65	6·6	4	—	2,000	200
6a.	Juice from inside diffuser at Cock 2	65	6·6	1	—	1,800	100
7.	Cock 3	67	6·3	5	—	2,100	2,000
7a.	Cock 3	70	6·4	0	—	1,700	<100
8.	Cock 4	64	6·2	0	—	600	<100
9.	Cock 6	65	6·2	0	—	300	200
10.	Juice from inside diffuser at cock 8	70	6·2	0	—	200	<100
11.	Cock 10 (middle of diffuser)	71	6·2	2	—	300	300
11a.	Cock 10 (middle of diffuser)	71	6·2	0	—	500	<100
12.	Cock 16	73	6·1	2	—	200	100
13.	Cock 18 (cossette end)	76·5	6·2	0	—	<100	<100
13a.	Cock 18 (cossette end)	74	6·1	3	—	1,200	200
14.	Wall section between cocks 1 and 3	—	—	–	—	600	40
15.	Section at the back of a trough at Cock 8	—	—	–	—	<100	300
16.	Foam at the baffle between cocks 7 and 8	—	—	–	—	1,000	<100
17.	Juice at the back of a trough at cock 10	—	—	–	—	100	100
18.	Cock 10 (middle of diffuser) after 80 min standstill	—	6·1	0	—	100	100
19.	Cock 10 after 3 hr standstill	—	—	1	—	600	300
20.	Raw juice before separator	78	6·1	0	—	800	<100
20a.	Raw juice before separator	78	6·1	1	—	700	<100
21.	Raw juice before pulp-trap	50	6·2	3	300,000	2,000	200
21a.	Raw juice before pulp-trap	50	6·2	4	100,000	1,800	300
22.	Raw juice after pulp-trap	50	6·2	6	900,000	11,000	1,000
22a.	Raw juice after pulp-trap	52	6·2	5	600,000	4,000	400
23.	Re-cycled pulp	48	6·1	42	6×10^6	60,000	700
23a.	Re-cycled pulp	—	—	40	750,000	70,000	500

§§ based on 1 g of material

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As bacterial colonies and foam enriched with bacteria are very easily formed with spray diffusion further tests were conducted. No whitish coloration of the inner wall screens, which often indicates a marked bacterial growth, was observed. For a more accurate check, about 25 sq.cm. of the inner surface of the diffuser near the upper observation windows between sampling points 1 and 2 or 9 and 10 was wiped with a sterile swab. The swab was rinsed in 10 ml of sterile water and 2 ml of this water subjected to a bacterial count determination (corresponding to about 5 sq.cm. of wall surface). The bacterial counts were fairly low and showed no indication of bacterial colonies in these sections of the diffuser (Nos. 14 and 15).

A somewhat higher number of thermophiles was found (16) in foam which had formed inside the diffuser on a baffle between sampling points 7 and 8. On the other hand, the juice dripping on the back of the cross channel—also inside the diffuser—showed the same bacterial count as the main juice stream at this point (17). No marked deterioration in the microbiological conditions of the diffuser were observed after up to 3 hours' standstill (Nos. 18 and 19). This favourable condition was nevertheless due to the prevention of bacterial growth by additional doses of formalin. During any long standstill, 55 litre doses of formalin were added apart from the usual amounts. The raw juice before the separator (circulation juice) showed no increase in the bacterial count (Nos. 20 and 20a), obviously because of its high temperature. Only during the final cooling of the raw juice was any increase detected in the number of thermophiles before the pulp trap (21 and 21a).

In the raw juice pulp trap itself there was a certain increase in the bacterial activity and count (Nos. 22 and 22a). The pulp was pumped with some flume juice (raw juice) to the fresh cossette feed. The returned pulp was rather heavily infected, as was indicated by the high bacterial activity and the large number of thermophiles (23 and 23a). At the time of the tests this infection had no further effect in the diffuser, probably because of the high temperature at the feed point.

Special Tests

(*a*) *Colloid content of the raw juice* (*pectin and albumin*)

The results of tests on raw juice samples withdrawn on three different days are given in Table 7. The colloid content (complete flocculation with methanol) was very high at 1·242 g/200 ml raw juice. This figure will be found with diffusers operating with cossette pre-scalding, as in this case. High even for these conditions, the colloid content indicated that the scalding temperature was somewhat too high or that there was occasional over-scalding as a result of the temperature fluctuations mentioned above. In addition, the period during which the cossettes were under the influence of temperature also had the same effect.

Table 7

Pectin and albumin content of raw juice

Sample	1	2	3	Mean
Amount of floc in 200 ml raw juice ..	1·335 g	1·085 g	1·305 g	1·242 g
% galacturonic acid in ppt.	19·6	23·6	22·8	22·0
% pectin in raw juice (on Brix)	0·713	0·732	0·822	0·756
% nitrogen in ppt. (Kjeldahl)	3·34	3·75	3·55	3·55
% albumin (on Brix)..	0·76	0·73	0·80	0·76

Thus, the pectin content of the raw juice was very high at 0·76% on Brix. The raw juice also contained an abnormal amount of albumin (also 0·76% on Brix). This could be due mainly to the abnormal beet during the drought, as we determined this range elsewhere during that campaign. In these De Smet factories the total N content of the raw juice was also much higher than the normal values (the total N content of the raw juice was 0·73% on Brix). Surprisingly the raw juice contained no coarse sediment, as was shown by settling tests in an Imhoff vessel. Thus, the cossette blanket in the diffuser acted as a very good filter. The pulp particles that leave the diffuser are thoroughly trapped in the raw juice pulp trap and then remain on the cossette layer on return.

(*b*) *Exhausted cossettes, press-water*

As practically no mechanical impurities were detected in the raw juice (there was hardly any sand), it must be assumed that the nature of the diffuser causes these foreign bodies to remain mostly in the cossette mass. Considering the very dirty state in which the beet were delivered and the moderate washing, considerable quantities of dirt and sand would be expected in the pulp. This hypothesis was checked by removing exhausted cossettes from the diffuser and washing with water. Two cossette samples each weighing 2·6 kg were examined. The dry solids figures given in Table 8 show the amount of mechanical impurities (sand, pulp) in the wash water, based on the quantity of exhausted cossette (dry solids). Even if these random samples yielded

Table 8

Adhering constituents of exhausted cossettes

(2·6 kg exhausted cossettes at 7·81% dry solids = approximately 203 g dry solids)

Sample	1	2
Sand + soil	8·85 g = 4·4%	6·08 g = 3·0%
(residue on ignition)	(76·1%	77·3%)
fine pulp	1·13 g = 0·6%	1·19 g = 0·6%
coarse pulp	2·15 g = 1·1%	3·81 g = 1·9%

no conclusive evidence (at times the foreign body content in the individual cossette ("filter") layer varies considerably) the values obtained did show that the exhausted cossettes did have considerable quantities of sand adhering to them. In connexion with this, the press-water was found to carry considerable quantities of sand with it. Large amounts settled out in the concrete tank (this deposit containing only 14% organic matter). Nevertheless, the sand content in the water was still high enough for the Alfa-Laval heater to be blocked several times.

(*c*) *Corrosion*

No tests were conducted on the effect of corrosion. A certain danger could exist, as large areas of juice-metal surfaces are in contact in the presence of air.

SUMMARY

The De Smet diffuser is a continuous diffuser with forced feeding of cossettes and juice, with good mechanical adaptability as regards cossette conveying and juice circulation. When working approximately at nominal capacity, the extraction efficiency of the diffuser tested was expressed in diffusion losses of 0·18% pol on beet, at a juice draught of 114%. The retention times of the cossettes was 103 minutes.

A high extraction efficiency was achieved, in spite of the fact that the uniformity of the beet feeding at times could have been better. The processed cossettes were of average quality. The measuring and control elements provided worked really satisfactorily throughout. The sugar extraction corresponded to a highly trouble-free counter-current extraction. The temperature maintenance in the diffuser was nearly uniform. No pronounced foaming was observed during the test period.

Routine additions of 135 litres of formalin to the diffuser and 30 litres to the press-water daily resulted in highly satisfactory bacteriological conditions throughout. No bacterial colonies were found. The conditions at the factory for operation of the unit were comparatively unfavourable. A large number of micro-organisms entered the diffuser with both the fresh cossettes and the press-water. High bacterial counts and activity were found in the cooling zone at the water end of the diffuser, although these did not affect the rest of the diffusion plant.

As a result of the good filtration properties of the cossette blanket, the raw juice contained practically no mechanical impurities, although the pectin content was relatively high, possibly owing to the excessive temperatures or to temperature fluctuations during pre-scalding. The albumin content was also high. This may have been caused by the abnormal beet resulting from drought conditions. If hot fresh water is to be used (severe pressing of cossettes for drying) cossette cooling, which is very convenient, will be omitted. This will increase the time during which the cossettes are affected by temperature. To prevent deterioration of raw juice quality and the pressing qualities of the exhausted cossettes, the cossette conveyer should be speeded up—possibly by reducing the thickness of the cossette blanket. Considering the mechanical adaptability of the unit, this should be easy to carry out without any noticeable effect on extraction.

ACKNOWLEDGMENTS

We offer our sincerest gratitude to President de Smet and Director Ferté of Vic-sur-Aisne sugar factory, for allowing us to carry out the tests. Further, we wish to thank the Svenska Sockerfabriks Aktiebolaget and the Suddeutschen Zucker A.G. for their financial assistance.

THE PRODUCTION OF BOTTLERS' SUGAR, USING A RAPID POLAROGRAPHIC TEST FOR ASSESSING SUITABILITY

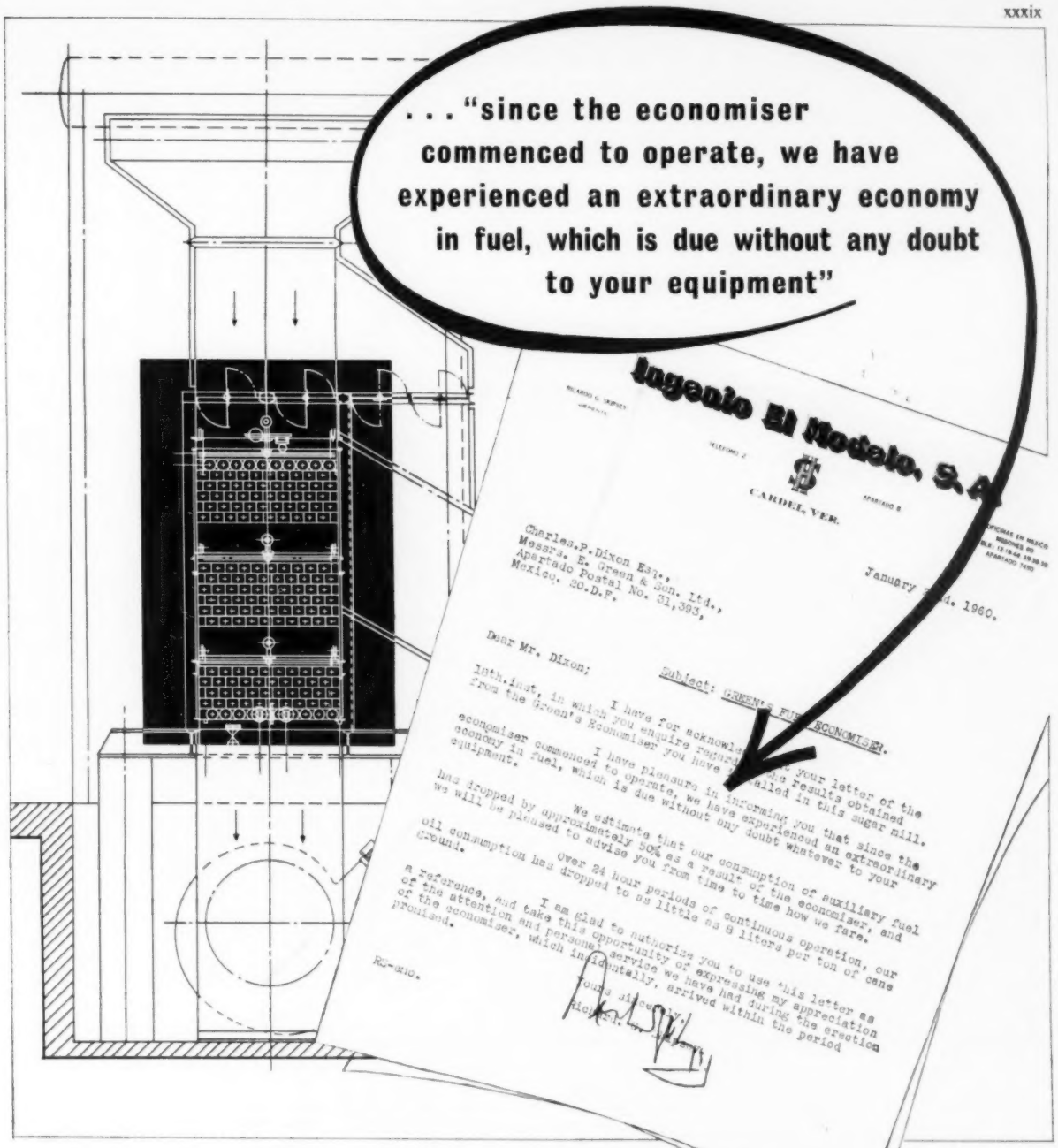
By D. HIBBERT, T. LANGHAN, W. WALKER and G. WILSON

Paper presented to the 20th Annual Meeting of Sugar Industry Technicians, Inc., and to the 14th Technical Conference, British Sugar Corporation Ltd., 1961.

FOR several years now, much attention has been focussed on the tendency of certain sugars to yield a flocculent precipitate in acidified solutions; the turbidity formed in this way has proved particularly disadvantageous to manufacturers of clear carbonated beverages, in which the precipitate is unsightly and may not appear until some considerable time after the beverage has been made.

Although this phenomenon has largely been attributed to sugars originating from beet, it would appear that it is associated less with the actual origin of the sugar than with the specific manufacturing techniques by which the sugar is made. In general, sugars boiled from char-treated liquors seem to be far less prone to floc-formation and, of course, the white sugars produced by beet-processing companies are rarely so treated.

It has been known for many years that the tendency in such white sugars of beet origin to floc-formation in acidified solutions may, at least to a great extent, be attributed to traces of a glycoside of oleanolic acid (saponin); although this material is present to a considerable extent in beet, it is largely eliminated in the carbonatation process. Traces, however, survive this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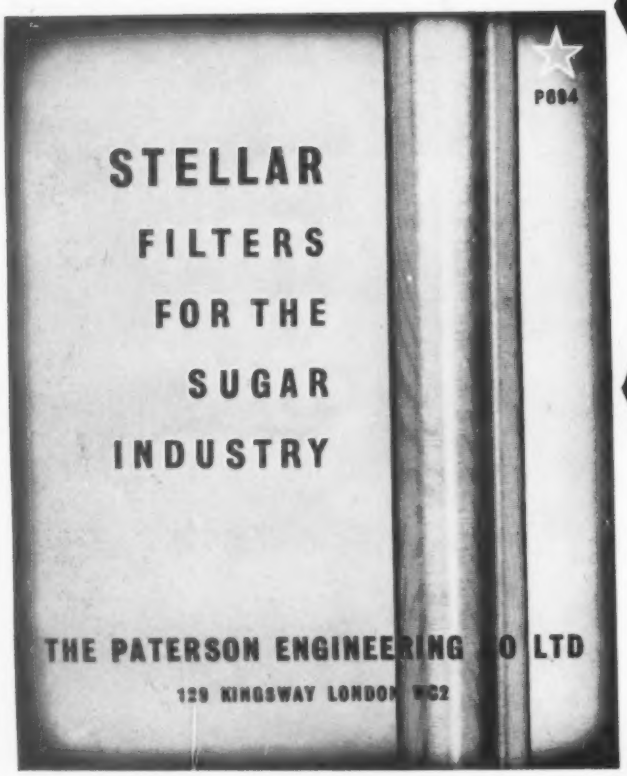

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treatment and may be found in the final product, and will be precipitated by acidification of a solution of the sugar. EIS *et al.*[1] and WALKER & OWENS[2] have shown, however, and our own work has confirmed this, that the floc formed is by no means exclusively composed of saponin; data obtained by CARRUTHERS[3] show that the actual saponin content of the floc formed in acidified solutions of British beet sugars is in general less than 20%. Furthermore, there is ample evidence to show that appreciable floc-formation in acid solutions may occur with some sugars of cane origin in which the saponin content is negligible.

Assessment of Suitability of Sugar for Carbonated Beverages

A number of methods have been suggested in the literature for assessing the tendency of sugars to formation of floc in carbonated beverages. Earlier work has centred mainly on an arbitrary classification of the visual appearance of solutions, acidified to a pH of 1·5 or lower, and allowed to stand for a time. Some authors have advocated a preliminary heating of the solution whereas others have not considered the initial heating desirable.

More recently the assessment of sugar suitability has been based more and more on the actual measurement of saponin contents of sugars based primarily on the method of STEINLE & KAHLENBURG[4] in which use is made of the colour reaction between triterpenes and antimony pentachloride. The methods of WALKER[5] and of WEST & GADDIE[6] for instance depend on this colour reaction.

There is no doubt however that neither the visual estimation of floc nor the colorimetric measurement of saponin contents is without difficulties and disadvantages. The former is lacking in accuracy and objectivity and the latter is not only a lengthy and involved analytical technique, but involves the use of a reagent which is extremely difficult to prepare and maintain in a sufficiently high degree of purity. Moreover, there is difficulty in ensuring the reproducibility of samples of standard saponin used in the test.

Apart from these considerations, it is our opinion that although saponin measurement can under certain circumstances serve a very useful purpose, a more general estimation of surface-active impurity traces is more desirable when it is required to assess the suitability of a sugar for bottling purposes. Moreover, it appeared to us that the depressive effect of surface-active impurities on the polarographic oxygen maxima of sugar solutions might well provide a suitable basis for a general estimation of this type.

Much of the pioneer work in the applications of polarographic techniques has of course been carried out in Czechoslovakia where, in particular, the work of VAVRUCH[7,8] has been especially directed towards a study of the evaluation of sugars on the basis of their polarographic behaviour. Additionally, OHASHI[9], in Japan, has published a paper in which he considers the polarographic behaviour of sugars on the basis of a rather more complicated concept than that of VAVRUCH.

In our own work we have found the simpler method of VAVRUCH more suitable for our own application and in the Appendix to this paper we have included a concise description of the polarographic method currently in use within the British Sugar Corporation for routine testing of sugars; it will be noted that this is almost identical with that proposed by VAVRUCH. The main advantage of this method for routine test purposes is its rapidity—a determination can be completed within about 10 minutes, which means that a sugar sample can be taken at the commencement of a strike and assessed in ample time to decide whether or not it is suitable for bagging as "Bottlers' Sugar."

Perhaps its only disadvantage from our point of view is that the actual peak height given by any particular sugar is dependent very much on the capillary characteristics of the dropping mercury cathode, and a change in the capillary used inevitably means a minor change in the standard regarded as acceptable. Nevertheless, we have been able to select capillaries in such a way that we can say that under the conditions of our test, a sample of sugar having a polarographic peak height of 8·0 μA or higher is suitable for use as bottlers' sugar. In numerous tests on a wide range of sugars we have never found evidence of floc formation in acidified solution where the peak height has been of this standard. Moreover, whenever we have examined sugars of beet origin, we have found that in those sugars having peak heights of 8·0 μA or over, the saponin content, as measured by a colorimetric method using antimony pentachloride, has always been less than 1·6 mg/kg.

Application of the technique at a refining factory

During the summer of 1959, one of the factories of the British Sugar Corporation was refining raw sugars of both beet and cane origin, without the use of char or activated carbon treatment. The essential features of the process then in use may be summarized as follows.

The factory was accepting raw sugar in bulk, and handling some 430 tons per day. The incoming raw sugar, together with 3rd product and after-product sugar, was mingled in a short scroll with affination syrup and sufficient lime to give a pH of 8·0, the magma being spun at a temperature of about 35°C and washed with water, part of the affination syrup being recirculated, and part being used in boiling the third raw and crystallizer massecuites.

[1] *Ind. Eng. Chem.*, 1952, **44**, 2844–2848.
[2] *J. Agric. Food Chem.*, 1953, **1**, 450–452.
[3] Private Communication.
[4] *J. Biol. Chem.*, 1926, **67**, 425.
[5] *J. Amer. Soc. Sugar Beet Tech.*, 1956, **9**, 233–237.
[6] *ibid.*, 146–152.
[7] *Collection Czechoslav. chem. Commun.*, 1950, **15**, 217–231.
[8] *Anal. Chem.*, 1950, **22**, 930–932.
[9] *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1954, **3**, 55–78.

Affined sugar was melted in sweet water from the presses plus hot-well make-up to about 43°Brix, with the addition of soda ash at a rate of 140-g per minute; a triple batch lime addition to the juice was in use, with an interval of six minutes between additions and a total lime addition of about 3·7% CaO on melt. Gassing to an alkalinity of 0·012 was followed by plate-and-frame press filtration. Subsequent sulphitation to pH 7·5 was followed by a further filtration and normal evaporation to a thick juice of 66 Brix. Filtered thick juice was used for boiling the first (straight) white massecuite, the resultant green and wash syrups being used, after filtration, for finishing off the second (1st mixed) white massecuite. This cycle was repeated until the white massecuite colour reached a value of 350 (measured with green filters on the Hilger "Spekker" absorptiometer); this normally occurred at about the ninth white massecuite, from which green and wash syrups were discarded at about 93 true purity.

The remainder of the sugar-house manipulation was carried out as shown in Figure 1 below, in which the purities are shown.

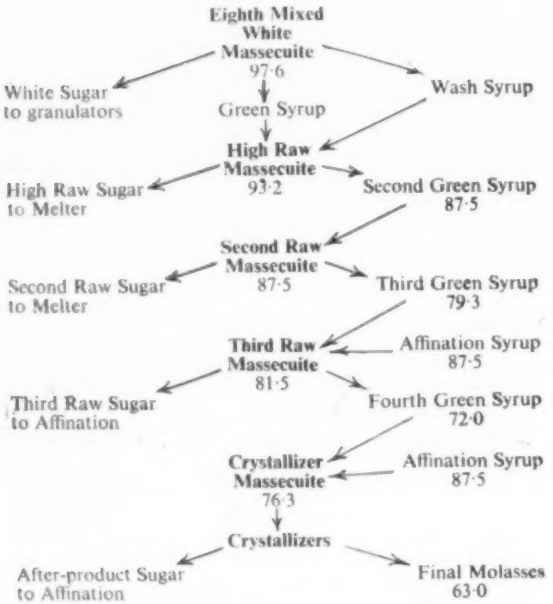

Fig. 1

Under the conditions described above the normal polarographic peak heights of the sugar produced fell within the range of 4·0 μA to 7·0 μA when melting Cuban raws, and between 5·0 μA and 7·5 μA when melting British raw beet sugars. Furthermore, although a number of minor alterations were made from time to time in the processing technique, it was at no time found possible to produce white sugar with the desired 8·0 μA peak height while melting Cuban raws.

The fact, however, that normal operation with beet raws yielded sugars with peak heights as high as 7·5 μA gave grounds for supposing that by certain modifications, it might well be possible to achieve the desired result. Following on previous laboratory investigations it was considered that the question of lime addition was probably of the greatest importance and an endeavour was made to increase the lime usage substantially, while at the same time avoiding such a high rate of addition as would entail an excessively long carbonatation treatment. In practice, it was found that, by increasing the lime addition to about 4·5% CaO on melt, a substantial increase in polarographic peak heights in the white sugar was noticeable. Additional experimentation over a prolonged period suggested that one or two other features of the processing technique also affected the final result. In particular, the closest attention had to be paid to ensuring a good pan-poiling technique resulting in minimum conglomerate formation in the white massecuite followed by efficient washing of the white sugar and, furthermore, great care in the purging of intermediate and after-product raws also had a favourable effect; there was some indication that temperatures in excess of 80°C at any stage of the process might have some detrimental effect, and that general sterility throughout the factory was also an important factor.

When the above points were taken into consideration and applied in practice, it was found that, while melting raw beet sugar, white sugar of the required polarographic standard could be produced with consistent regularity, although this was restricted in general to the straight and first and second mixed white pans. Typical average polarographic heights for white sugars produced over a period of one week were as shown below in Table 1.

Table 1

Origin of Sugar	*Peak Height (μA)*
Straight Pan	8·6
1st Mixed Pan	8·4
2nd Mixed Pan	8·1

Application of the Technique at a beet sugar Factory

In the British Sugar Corporation there are twelve factories producing high-grade direct consumption white sugars from beet and initial laboratory examination of numerous sugar samples from these factories showed appreciable variation in respect of their polarographic oxygen maxima. At two factories, the results were, however, consistently at a reasonably high level and at one of these it was decided to carry out certain experimental work with a view to achieving even better results.

The normal technique in operation at that factory at the beginning of the 1960/61 campaign can be summarized as follows.

The factory has a capacity of 2800 tons per day, and employs two 14-cell Robert diffusion batteries, operating at 75° to 76°C, with a draft of 125% on

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beet and full water return; battery supply water pH is kept at about 6·0 by formaldehyde addition to the battery. Raw juice is heated to 80°C; first carbonatation is continuous and simultaneously with the liming and gassing, first carbonatation juice is recirculated at 5000 gallons per minute. Alkalinity is controlled at 0·125 g CaO/100 ml and normal lime usage is 2·0% CaO on beet. A Dorr-Oliver ATV clarifier is in use, two compartments only being used, giving a retention time of about 30 minutes.

Overflow from the clarifier is pumped through a heater to the second carbonatation tanks where it is treated with sufficient soda ash for optimal lime salts conditions; gassing is carried out at 90°C to a pH of 9·2 to 9·3, and the filtered second carbonatation juice is brought to pH 8·0 to 8·5 with SO_2. Evaporation of the thin juice, the lime salts in which are normally 0·014 to 0·018 g CaO/100 ml is carried out in a quintuple effect system, giving a thick juice of about 65° Brix at 85°C and 7·2 to 7·3 pH.

After-product sugar is dissolved in evaporator thick juice, after the latter has been heated to 100°C, in a mingler which overflows into the main melter. After-product sugar can be made into a magma with water in this mingler and passed to the raw centrifugals where it is spun with the raw massecuite giving some improvement in white massecuite colours. In the main melter raw sugar is dissolved in the evaporator thick juice and part of the wash syrup from the white centrifugals is added. The result is a standard liquor of about 70° Brix and 92·5 purity which is heated to 90°C; this liquor, after plate-and-frame press filtration is used for boiling the white massecuite.

The remainder of the sugar-house manipulation is carried out as shown in Figure 2 below, in which the purities are shown.

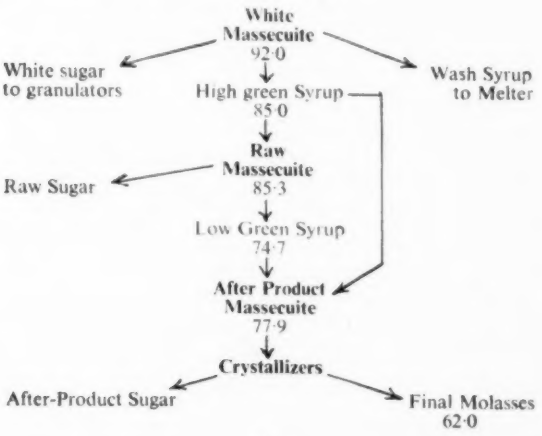


Fig. 2

Under the conditions described above the polarographic peak height of the white sugar produced had an average value of about 6·0 μA with very little variation between individual strikes. It was considered that these values were sufficiently high to warrant a serious attempt to produce sugar at this factory with the desired polarographic peak height of 8·0 μA. By analogy with the previous work carried out at the refining factory and referred to above, the possibility of bringing about an improvement by use of additional lime was investigated, but this was not found to have any effect on the polarographic quality of the white sugar.

GADDIE & WEST[10] had shown that, under the conditions prevailing at certain factories in the Utah-Idaho Suga. Company, saponin content of white sugar could be substantially reduced by boiling white massecuites at high pH levels of the order of 9·0, these pH values being achieved by the addition of caustic soda. On the basis of this work it seemed logical to attempt such high pH boilings under our conditions and this was in fact done.

Working with a standard liquor of 7·0 pH, the initial charge to the white pan was treated with caustic soda solution to pH 9·0 and, subsequently, throughout the boiling, the pH was maintained in the range 8·8 to 9·1 by further additions of caustic soda; for the entire pan (1200 cubic feet massecuite), the addition of caustic soda amounted to 170 lb. This treatment was repeated on five occasions, and none of the resulting white sugar showed any improvement whatever in polarographic quality, compared with the normal production boiled at a pH of 7·0. Moreover, when for a further period of two days, operating conditions were altered in such a way as to raise pH values throughout the process to a minimum of 8·0, there was still no effect whatever on sugar quality as measured polarographically.

In view of the negative results obtained in these experiments, we were led to the consideration that the conditions at this factory might be very different from those encountered by GADDIE & WEST in their work, and that, in fact, the depression of polarographic peak heights in our sugar might in fact be due less to saponin than to other surface-active impurities. Subsequent laboratory investigations gave ample support for this supposition, and numerous determinations showed that, even under normal operating conditions, the saponin content of white sugar at our factory rarely exceeded 0·5 mg/kg although three samples gave results between 0·6 and 1·7 mg/kg. Moreover, the normal saponin content of the standard liquor at this factory was of the order of 12 mg/kg dry matter, which seems to be considerably lower than the figures generally found by investigators in the United States.

Earlier laboratory experiments had demonstrated clearly the importance of very precise control of carbonatation conditions in order to ensure minimum surface activity of the resulting juices and, in factory practice, this was confirmed to some extent by the relationship which was found to exist between lime salts in thin juice and polarographic quality of white sugar. Only during periods when lime salts were at

[10] *J. Amer. Soc. Sugar Beet Tech.*, 1958, **10**, 171–176.

a very low level did the peak heights of the sugar show any improvement over the average value of 6·0 μA.

Not only was this relationship apparent in practice but there was also evidence to suggest that a reduction in the ash content of the standard liquor had a favourable effect; in order to achieve the best conditions from this point of view, it was found advantageous to mingle the after-product sugar with water to 92° Brix and to feed this magma to the raw centrifugals with the raw massecuite.

Although, by taking advantage of the considerations outlined above, a certain improvement in polarographic quality of white sugar could be achieved, it was still not possible consistently to reach the desired level of 8·0 μA, and it was concluded that this could not be done without in some way increasing the purity of the white massecuite. Over a period of time, there had been many indications that a definite relationship existed between white pan purity and sugar quality as measured polarographically. Unfortunately, with the plant available it proved impossible to bring about this increase in purity by any normal manipulation without a substantial loss of capacity which, at the time in question, would have been quite unacceptable.

In view of this, use was made of a quantity of damaged white sugar which required remelting and was available at the time at the factory. For a period, this sugar was added to the melter at such a rate that the standard liquor purity was raised to between 94 and 95. This procedure was found to be most effective, and the sugar boiled from the resultant standard liquor consistently showed polarographic peak heights at the desired level of 8·0 μA or higher. Not only was a satisfactory sugar produced, but it was found possible to maintain the high level of purity in standard liquor for reasonable periods without any serious effect on the throughput of the factory.

A typical analysis of the white sugar produced in this way is shown below in Table 2.

Table 2

Polarographic peak height (μA) ..	8·2
Conductimetric ash, %	0·007
Saponin, mg/kg	0·5
pH	5·7
Coca-Cola floc test (at 10 days) ..	Negative

It is difficult to state precisely what factors influenced the successful production during the beet campaign of white sugar of the required polarographic quality, but, as a result of the many experiments carried out, it seems that attention to the following points may be the most important factors.

(*a*) All beet end work must be regulated to obtain the very best quality juices with minimum lime salts.

(*b*) Purity of standard liquor should not fall below 93 and should preferably be higher.

(*c*) Impurities originating from after-product sugar and passing to standard liquor should be kept to a minimum.

(*d*) Normal pH control should be maintained throughout the factory, resulting in a molasses pH of 6·8 to 7·0.

(*e*) Closest attention should be paid to pan-boiling technique to minimize the formation of false grain and conglomerates.

(*f*) Usage of foam preventatives must be reduced to an absolute minimum—a point which was emphasized by GADDIE[11] and which we have found to be of the utmost importance.

APPENDIX

Method for Polarographic Assessment of White Sugars

13 g of sugar are weighed out and transferred to a 50 ml stoppered graduated flask, and 5 ml of a 0·02N solution of potassium sulphate added; after dissolving the sugar in well-aerated distilled water, the solution is made up to the mark at 20° C. The solution is then transferred to a polarographic cell containing about 3 ml of mercury which serves as the anode. The cell is placed in a water-bath at 25° C for at least 5 minutes, after which the dropping mercury cathode and the anode connexion are inserted. Using a Tinsley Mark 19/2 polarograph (Evershed & Vignoles Ltd., Acton Lane Works, Chiswick, London W.4, England) a polarogram is recorded from approximately —0·5 volts to —1·2 volts, which covers the entire range of the oxygen maximum. Maximum damping is employed to facilitate subsequent measurement of the peak height, and a sensitivity setting to give a full-scale deflection of 20 μA is used.

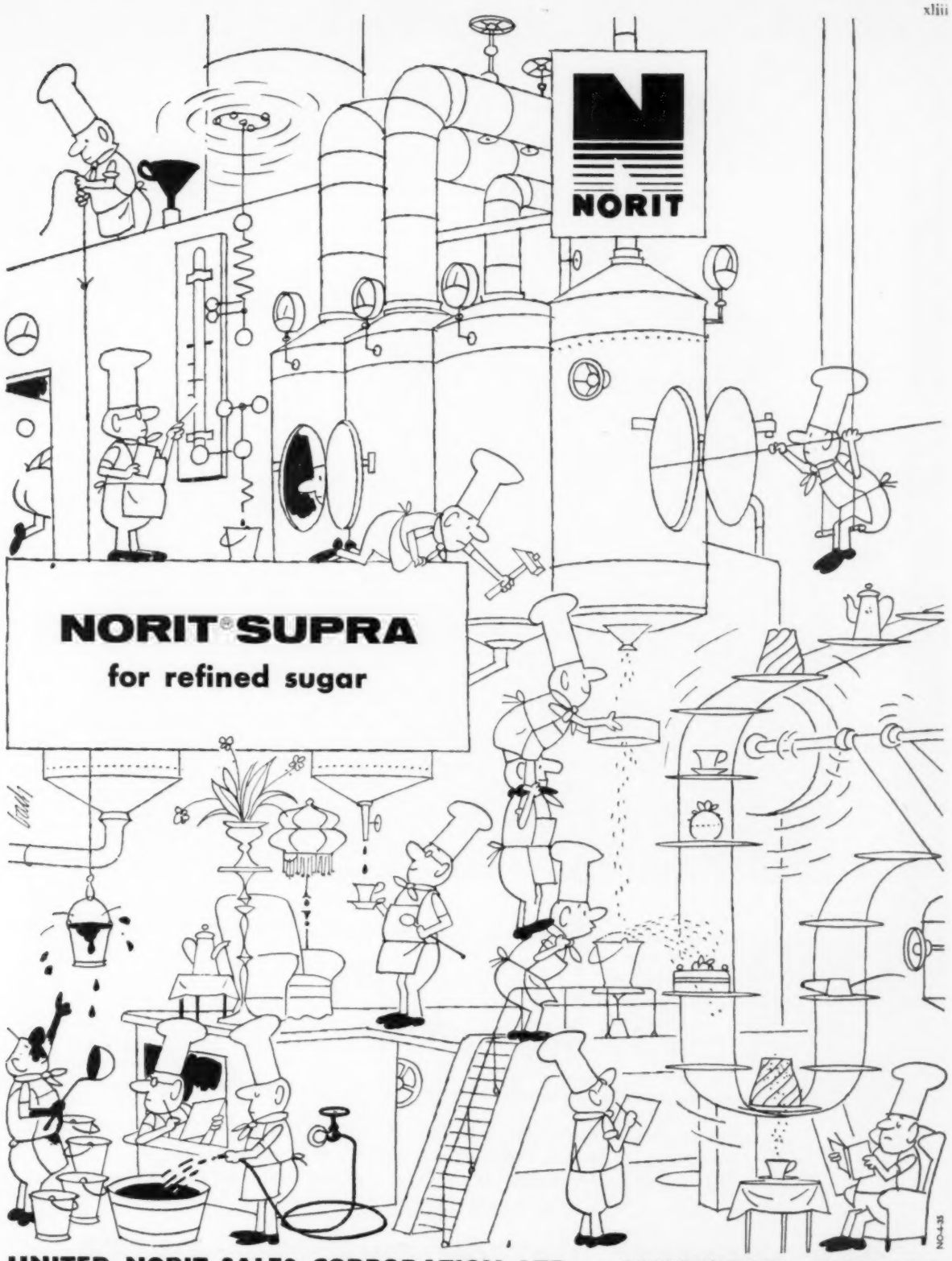
In view of the known fact that a number of variables can affect the polarographic peak height recorded, a similar solution of a pre-selected standard sugar with a known peak height of 8·0 μA is used as a control.

As a basic standard, specially pure sugar is prepared by the method described by VAVRUCH[7] and capillaries are selected in order to give a peak height of 12·0 μA on this sugar. The capillaries selected and found suitable under our conditions have a diameter of 0·07 mm and are adjusted to give a drop rate of 3 to 3·5 seconds; this is normally achieved with a mercury head of about 30 to 40 cm.

It is of course of the utmost importance in the application of this method that all apparatus should be scrupulously clean.

New Malayan sugar factory[12].—Early in 1962 a new sugar factory is to be put into operation at Batu Tiga, employing 200 workers, while 3000 will work in the cane plantations of Tanjong Karang. The daily sugar production will reach 120 tons, and the machinery is to be supplied by Taiwan.

[11] *ibid.*, 1956, **9**, 189–192.
[12] F. O. Licht, *International Sugar Rpt.*, 1961, **93**, (Supp. 12), 162.



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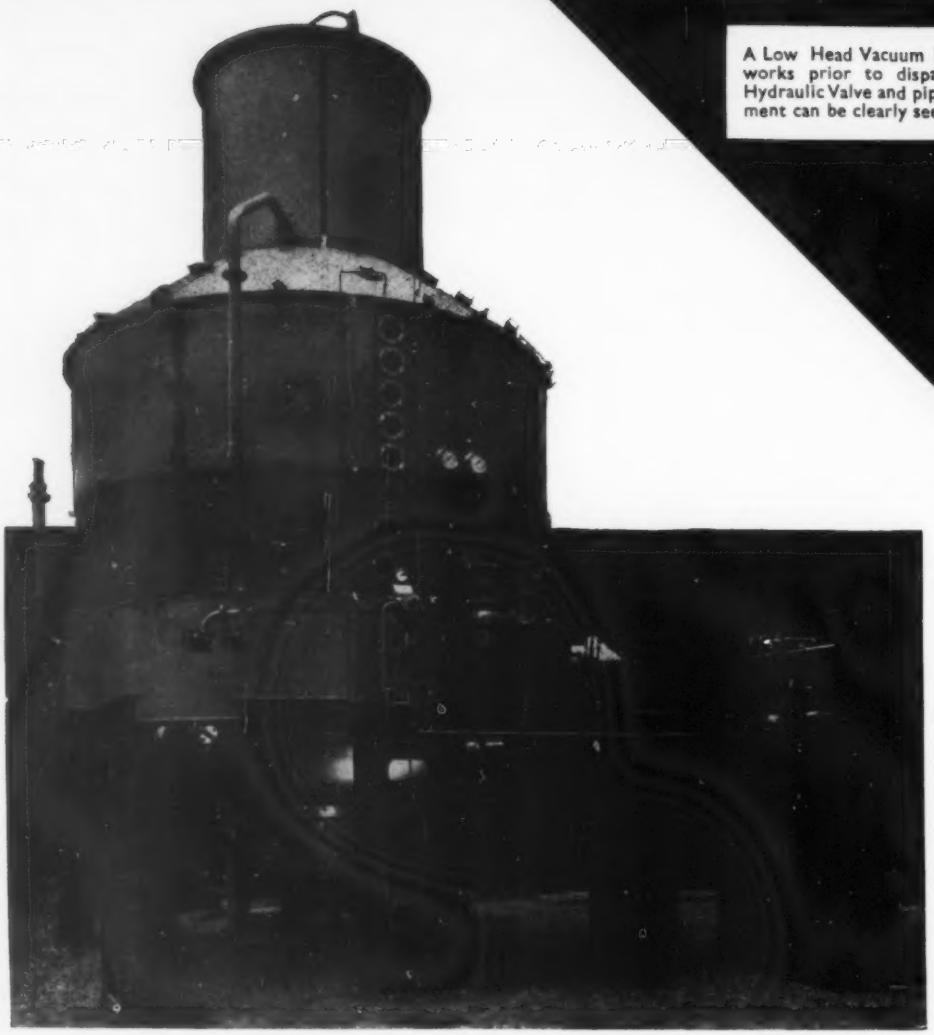

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Processing of sugar manufacture affected by cane trash. W. L. TSAI, H. H. TING and M. C. TSAI. *Taiwan Sugar*, 1961, **8**, (1), 24–27.—Data are tabulated of pol extraction and cane trash content obtained from 29 mills during 4 seasons, and tests are described in which trash was added to crusher juice and the juice purity determined after a given time. The crushed trash was also added to clean cane before milling. The deleterious effect of trash on juice purity is clearly demonstrated, i.e. a 0·628% purity drop per 1% increase in trash content. It is shown that a loss of more than NT$1·00 per ton of cane results from the milling of trashy cane.

* * *

Improving filtration efficiency in (the) carbonatation process. A preliminary pilot plant experiment on the use of (the) Schumacher porcelain filter. W. CHEN, S. H. WU, Y. C. CHENG and M. T. TSAI. *Rpt. Taiwan Sugar Expt. Sta.*, 1960, (21), 39–48; through *S.I.A.*, 1961, **23**, Abs. 100.—The effect of filtration of 2nd carbonatation cane juice at a constant flow rate under gradually increasing pressure, with initial pressures of 0·1–0·4 kg/sq. cm. and final pressures of 0·5–1·0 kg/sq. cm., upon the resistance of the cake was compared with the effect on cake resistance of constant pressure filtration at pressures of 0·5–1·2 kg/sq. cm. Filter aid was used at a rate of 1·25 kg/sq. cm.; it was found that the porosity of the porcelain was reduced when this rate was reduced below 0·8 kg/sq. cm. At constant flow rate, the initial clarity was better, the compressibility (0·54) of the cake was less than half of the compressibility at constant pressure, and the resistance under an equal pressure was correspondingly less. A flow rate of 1880 litres/hr of 2nd carbonatation juice per sq. m. gave the lowest ratio of specific cake resistance to pressure. At the normal working rate of 1250 litres/hr/sq.m. the capacity per unit area was about four times greater than that of a filter press, and the filtering cycle (8 hr) was longer.

* * *

On the question of the application of liquid sugar in the food industry. J. LEKAWSKI. *Przemysl Spozywyczy*, 1960, **14**, 528–532; through *S.I.A.*, 1961, **23**, Abs. 126.—The applications of liquid sugar in the U.S.A. and the processes employed in U.S. refineries are reviewed. Possible manufacturing processes and uses in Poland are discussed. The most economic starting material would be 2nd and 3rd product beet raws; a scheme proposed by S. ZAGRODZKI is described which employs two successive carbon treatments of the melt syrup separated by a treatment with an anion exchanger. Freshly burnt carbon is used for the second treatment and is passed back to the first treatment when partly spent. The following specifications are proposed for Polish liquid sugar: 65°Brix, sucrose $\leq$99·7%, reducing sugars $\geq$0·05%, ash $\geq$0·03%, colour $\geq$1° Stammer.

* * *

Application of ion exchange process for the clarification of cane juice. D. V. R. RAO and C. J. D. RAO. *Indian Sugar*, 1961, **10**, 699–700.—Ion exchange treatment of cane juice is discussed and a basic procedure described.

* * *

Progressive sugar industry of South Africa. A. G. HAMMOND. *Sugar y Azúcar*, 1961, **6**, (4), 37–40.—A general illustrated survey is presented of the South African sugar industry.

* * *

The Broadbent high-speed centrifuge. T. H. LIEM. *Balai Penjelidikan Perusahaan² Gula. Warta Bulanan* (*Proefstation Java-Suikerind. Maandberichten*), 1960, 200–206; through *S.I.A.*, 1961, **23**, Abs. 194.—The operating cycle and controls are described, with a short account of the basic equations of centrifuging. The new battery for D massecuites at Lestari factory, consisting of five semi-automatic 42 in × 24 in machines with a maximum speed of 1500 r.p.m. (three fore-workers and two after-workers), has an estimated capacity of 2000 tons of cane per day. The normal duration at maximum speed in the fore-worker cycle is 6 min with a massecuite temperature of 50–55°C. The effect of different periods at maximum speed on the purity of fore-cured D sugar was studied: the resulting purities were 89·8, 91·8, 93·4 and 94·1 for periods of 4, 6, 8 and 10 min respectively. The results are also quoted in units of molasses recirculation, calculated from the formula $K(100-k)/(k-K)$, where K = crystal content of the massecuite and k = crystal content of fore-cured D sugar, and are compared with the performance of an older 30 in × 18 in, 1300 r.p.m. belt-driven machine.

* * *

Bulk raw sugar handling by rail. L. K. DAVIS. *Paper presented to the 20th Ann. Meeting, Sugar Industry Technicians Inc.*, 1961.—National's New York Refinery and Reserve Refinery were able to receive bulk raw sugar shipments in 1959; however, the Philadelphia Refinery was only able to receive raw sugar in bags discharged at its own pier—an appendage to the refinery, jutting out into the Delaware River from its west bank. Almost 100% of Puerto Rican raw sugars were shipped in bulk during 1959. Other raw sugar suppliers were increasing bulk shipments rapidly. This changing situation presented the Philadelphia Refinery with the problem of developing bulk raw sugar receiving facilities quickly and with

no interruptions to its bag-receiving facilities so that it could maintain its more than 4,000,000 pound daily melt. The bulk ore receiving facilities at the Reading Railroad's Port Richmond Terminal were modified for use in discharging bulk raw sugar into railroad hopper cars, which could be conveyed to and discharged at the refinery by using rotary dumping mechanism[1]. Construction of the new facilities commenced in September of 1959 and the new system was placed in operation in March of 1960, handling over 400,000 tons by the end of the year.

* * *

Some methods of defecation and clarification of affination syrup. G. E. WARING. *Paper presented to the 20th Ann Meeting, Sugar Industry Technicians Inc.*, 1961.—The installation of a self-opening centrifugal separator was carried out to investigate its application to the clarification of defecated affination syrup. A comparison is made with other methods of clarifying. Brief mention is made of the sweetening-off of clarifier scums with the same equipment.

* * *

Carbonatation at the Savannah sugar refinery. J. W. ALBERINO. *Paper presented to the 20th Ann. Meeting Sugar Industry Technicians Inc.*, 1961.—The continuous carbonatation station at Savannah, which has been in successful operation on cane raw sugars for over eight years, is described. A flow diagram of the process is given with a description of the equipment in use. The methods of control are discussed, both in station instrumentation and in laboratory work. The materials used are mentioned, and the carbonatated liquor quality is reported. Finally, some of the advantages and disadvantages of this process are considered.

* * *

Refining of high purity washed sugar without affination. M. V. LOCSIN. *Paper presented to the 20th Ann. Meeting, Sugar Industry Technicians Inc.*, 1961.—The Victorias Refinery is the Philippines' major producer of refined sugar. It is a bone char refinery operating in conjunction with a raw factory that grinds cane for 10 to 12 months yearly. Faced with the problem of having to increase refinery output without overloading the raw factory with refinery syrup, the company installed a battery of eight high-speed, fully-automatic double-purging centrifugals to produce high purity A and B washed sugars. These were melted directly for the refinery without being affined. The resulting washed sugar liquor was comparable to that obtained from affined raws, no difficulties having been encountered in filtering it through the Sweetland filters and char filters. Production of washed sugar increased the final molasses output of the raw factory about 5%, but the net result was a substantial reduction of the load on the raw sugar pans owing to the elimination of affination syrup, thus permitting an increase in refinery production without encumbering milling operations. An apparent improvement in refinery recovery, which could be attributed to the reduction of second-run sugars in the melt, was also noted.

Test use of granular carbon at C & H sugar refinery. N. L. PENNINGTON and R. S. PATTERSON. *Paper presented to the 20th Ann. Meeting, Sugar Industry Technicians, Inc.*, 1961.—The operation of a test granular carbon installation in the C & H refinery at Crockett is discussed. Extensive laboratory column tests with the granular carbon demonstrated its decolorizing ability and led to a full scale plant test. Four char filters have been set aside for the granular carbon. They have been used to decolorize the darkest fraction of once char-filtered liquor to improve the overall colour of the liquor used for boiling white sugars. Decolorization cycles have averaged over 30 days running time. The carbon system has been in operation about a year and is performing much as originally anticipated. Decolorization of washed raw sugar liquor by carbon and bone char are also compared. Sweetwater production in sweetening-on and sweetening-off granular carbon filters is compared to sweetwater from bone char filters. Carbon losses and regeneration in a Herreshoff kiln are discussed.

* * *

A new white sugar building in London. F. M. CHAPMAN. *Paper presented to the 20th Ann. Meeting, Sugar Industry Technicians Inc.*, 1961.—This a general description of a building which went into operation early in 1960 at Thames Refinery. Designed output is approximately 6 million lb/day. Operating labour is five men per shift. Plant is arranged in four vertical lines and special features of the equipment are discussed.

* * *

The bulk density of granulated sugar and other factors affecting the specification of package dimensions. R. E. ROBERTS and A. M. HERTZBERG. *Paper presented to the 20th Ann. Meeting, Sugar Industry Technicians Inc.*, 1961.—The bulk density of granulated sugar was measured at six refineries to enable the dimensions of retail packages in the range 2 lb to 6 lb to be specified. An attempt was made to account for variations in uncompacted bulk density by varying the particle size distribution in synthetic mixtures of screened fractions of granulated sugar. Factors other than bulk density affect the choice of package dimensions, and a brief discussion is given of the process of meeting the multiple objectives of good appearance, economy, uniformity among refineries, and ability to form a satisfactory parcel—a process which is restricted by limitations imposed by the packaging equipment.

* * *

Pan operation at the Reserve Refinery. B. A. OXNARD. *Paper presented to the 20th Ann. Meeting, Sugar Industry Technicians Inc.*, 1961.—During the past year, many improvements were made on the pan floor. They resulted in better crystal quality, a higher yield of fine granulated sugar and a more uniform method of operation. Three instruments were put into operation on a 1800 cu.ft. low head calandria pan which boils No. 1 liquor. These instruments are:

[1] *I.S.J.*, 1961, **63**, 85.

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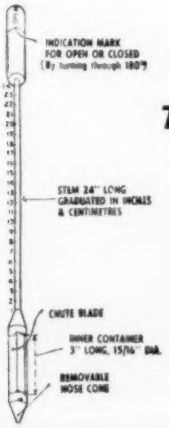
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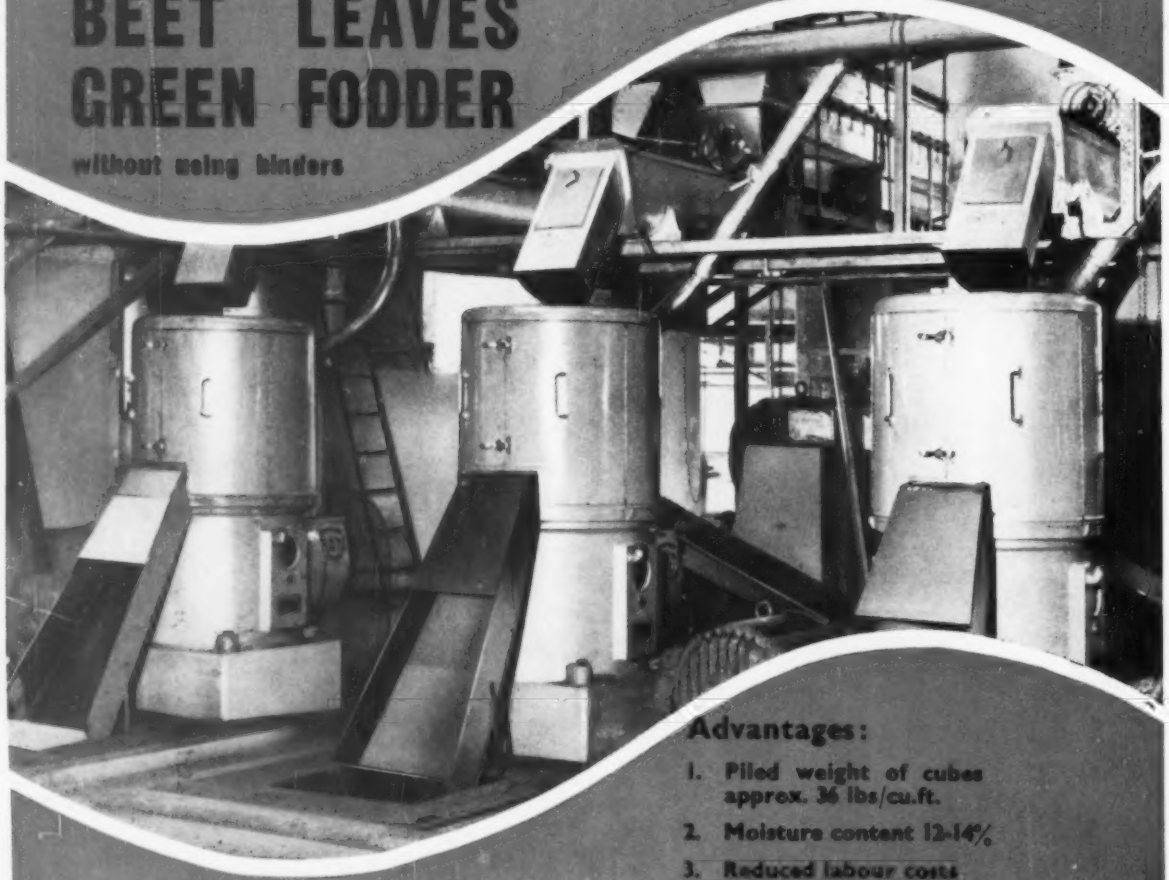

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vacuum, supersaturation and mobility recorder-controllers. Before the vacuum recorder-controller was installed, the operation of the condenser and the availability of raw water for proper control were investigated. The instruments and their operations are discussed and the sequence of operation is outlined. The improvement in pan boiling and subsequent increase in fine granulated yield are shown and a comparison is made of pan operation before and after instrumentation. In order to improve the circulation of the calandria pans, stationary louvres were installed. These louvres prevent the massecuite from short circuiting down the centre well. The first pan equipped with louvres was a 1400 cu.ft. low head pan that boils No. 3 remelt. The immediate improvement in boiling is discussed along with comparative data to show the benefits of the louvres. After the B pan louvres were installed, two more sets were put in: one for the 1800 cu.ft. E pan and the other for the 1000 cu.ft. D pan. The improvement in the boiling of these pans and the increase in sugar quality and yield are discussed.

* * *

Symposium: instrumentation and vacuum pan control in sucrose crystallization. E. D. GILLETTE, J. DONNELLY, P. HONIG, P. F. MEADS, P. H. PETRI and J. N. NOGATCH. *Papers presented to the 20th Ann. Meeting, Sugar Industry Technicians Inc.*, 1961.—Experiences with various methods of vacuum pan control are discussed, covering such topics as types of controls used, the problems and limitations connected with their use, and the benefits that should be realized when pan controls are properly applied.

* * *

Mechanized accounting for the sugar mill and the Bingera installation. G. A. CHENERY. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 21–28.—The mechanized accounting system at Bingera, installed two years ago, includes a "National" Class 32 accounting machine with 10 aggregating registers and incorporates direct multiplication. Details and advantages of the system are presented.

* * *

Automatic effet control—first year's experience. G. A. ANDERSON and K. A. STUART. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 29–33.—Details are presented of the automatic control scheme installed in Pleystowe in 1960 for the evaporator station, which comprises a pre-evaporator and a quintuple-effect evaporator. The controls cover liquid level, rate of evaporation and syrup density. While vacuum control was difficult to attain, with adequate Brix control there was little variation in vacuum under normal conditions. Modifications were found necessary to overcome the problem of excessive flashing which caused difficulties in transfer of juice from vessel to vessel. The installation has proved reliable after teething problems and has enabled a saving of one operator per shift. The control system has favourably affected operation of boilers, mills and pans.

* * *

Further observations on milling and mill feeding. H. D. DONNELLY. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 73–78.—The major factors affecting milling efficiency are discussed. These are: preparation, roller surface, feed presentation, mill settings and juice drainage. Of these, the condition of the roller surface is considered to have the greatest effect on milling, provided cane preparation is adequate. With the use of a "dirty" top roll, the bagasse mat should be completely unbroken. The numerous devices used to assist in feed presentation are described, including the underfeed roll used in Mauritius and which operated successfully at one mill in 1960. It is considered that with this, the larger the roller diameter the more effective will be the arrangement. Hints are offered on mill setting and juice grooves are considered beneficial.

* * *

Improving the performance of small mills. H. MACKAY. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 79–80.—At North Eton a correlation has been found between the performance of the milling train (consisting of four 60-in mills) and the peripheral speeds of the feed and delivery rollers relative to the top roll. When the speed of the top roll was less than that of these other rolls, milling performance was satisfactory, whereas performance was unsatisfactory when the top roll speed was the greater. Advice is offered on matching of roller speeds.

* * *

Some notes on milling train improvements at Mourilyan. C. H. FITZMAURICE. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 81–84.—It was found that a Searby shredder installed at the upper end of the cane carrier offered no advantage when relatively soft cane was crushed and in fact lowered milling efficiency. The cane was pulped and reached the mouth of the mill in large batches which were not readily accepted by the rolls. To effect more uniform feeding, the apron feed was lowered to form the lower section of a feed chute and thus acted as a compression unit to increase the bulk density of the feed at the mill entrance. Soft plant cane, however, caused bad mill slipping, some cane varieties being rejected by the mill. This was overcome by feeding lightly with the front plate of the chute hinged at the top and fitting two steam rams with their control valve within reach of the operator. A feed chute setting of 17 in at the top and 15 in at the bottom has been found to give good feed distribution. Performance figures of the No. 1 mill, which proved highly satisfactory, are discussed. Details are given of the underfeed rolls attached to No. 2 and 3 mills, which reduced the bagasse moisture content from 57–59% to 52–54% in No. 2 mill and from 54 to 51% in No. 3 mill.

Ion exchange process for beet sugar refining. I. Purification of beet diffusion juice. II. Purification of sugar solutions. G. ASSALINI and G. BRANDOLI. *J. Amer. Soc. Sugar Beet Tech.*, 1961, **11**, 341–357.—Details and economics are given of the Assalini "B" process[1].

* * *

Optimum heat utilization in the sugar industry. N. ALM. *Zucker*, 1961, **14**, 212–216.—Diagrams and tables are presented showing that with a quintuple-effect evaporator it is better to cool the condensate from each effect rather than flash, since in the latter case the condensate will have the same value as the steam resulting from flash evaporation in the corresponding effect (expressed here as kg water evaporation/kg steam) while use of the heat obtained by cooling the condensate will give a higher temperature in the juice heaters. In the choice of temperature drop in a heat exchanger the advantages obtained in the heat economy must be weighed against high capital costs. To have as low a temperature drop as possible would mean increasing the heat exchange surface accordingly, and no factors have been found which would favour such high costs.

* * *

On A. G. Rychkal's article, "Some technological features of processing of damaged beet and control of the technological production processes."[2] A. K. KARTASHOV. *Sakhar. Prom.*, 1961, (4), 15–17.—In this criticism the following points are made: (1) the pH of the withdrawn raw juice is no guide to the bacterial growth in diffusion; instead pH curves should be drawn for the complete diffusion process. (2) The elimination of main liming *is* practical and has resulted in improved juice filtration both in the Soviet Union and elsewhere; thus the pectins and pectic acid do not form lime salts, which are difficult to remove. To avoid decomposition of other compounds during later processes, the juice should be brough to pH 7·1–7·5 with SO_2 before evaporation. (3) The optimum pH of the 2nd carbonatation juice may vary from 8·8 to 10·5. The pH values recommended by RYCHKAL' would eventually cause considerable scaling of the evaporator with Ca sulphite and sulphate.

* * *

Lime kiln for burning of small particle limestone in a fluidized bed. A. T. TISHCHENKO. *Sakhar. Prom.*, 1961, (4), 18–26.—Details are given with diagrams of a fluidized bed vertical kiln (such as is used in the U.S.A. and elsewhere, particularly for the roasting of ore), for burning of limestone crushed to an average particle size of 1·8 mm. Natural gas is used as fuel, and test results indicate a specific capacity of 930 kg limestone/hr/sq.m. cross-sectional area with a CO_2 content in the waste gases of 19·3%. The limestone is burnt at 1000°C. Although burning is incomplete in a single-chamber kiln and the specific heat consumption is uneconomical, the results achieved were better than with a conventional shaft kiln and the kiln is more easily serviceable. Details with diagrams are also given of a multi-chamber kiln design, for a daily throughput of 12 tons of limestone, the specifications of which are based on the test results.

* * *

Heat insulation of equipment and pipelines at sugar factories. L. S. DONIN. *Sakhar. Prom.*, 1961, (4), 26–31.—Investigations have revealed that the surfaces of sugar factory equipment in the Soviet Union become very hot and heat the air around, considerable amounts of moisture and heat escaping from filters, clarifiers, liming and carbonatation vessels, etc. For the comfort of workers, adequate insulation of machinery is necessary and tables are presented of thickness of packing material at various temperatures and the corresponding heat losses. A formula is also presented for determination of the thickness of insulation.

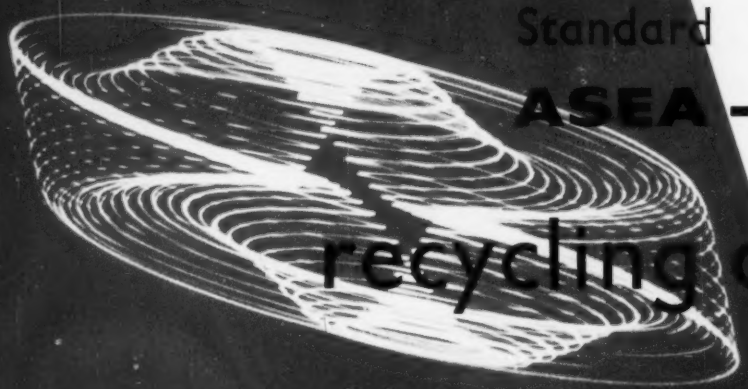
* * *

Determination of the duration of crystallization of final product massecuite. L. S. TVERDOKHLEBOV. *Sakhar. Prom.*, 1961, (4), 31–32.—Instead of the official formula for determination of the length of the crystallization process, which may give inaccurate results, a formula is presented based on a final molasses yield of 50% on massecuite weight. The formula takes the form $K = \frac{v.100d.24}{C.2B}$, where K = duration of crystallization in hr, v = effective capacity of all the crystallizers in hectolitres, d = s.g. of massecuite, C = daily slice in zentners and B = molasses yield on weight of beet.

* * *

Disinfection of a diffusion battery. I. S. PROKHORCHUK. *Sakhar. Prom.*, 1961, (4), 32–33.—Formalin to be fed to the 3rd cell from the tail is stored in a 60–100 litre reservoir from which the necessary dose is pumped by hand vacuum pump to the diffuser when necessary. To decide when to add the formalin it is necessary merely to know the pH of the juice in the head cell, the 5th cell from the head and in the 3rd or 4th cell from the tail.

[1] *See I.S.J.*, 1960, **62**, 102, 232, 353.
[2] *I.S.J.*, 1961, **63**, 184.



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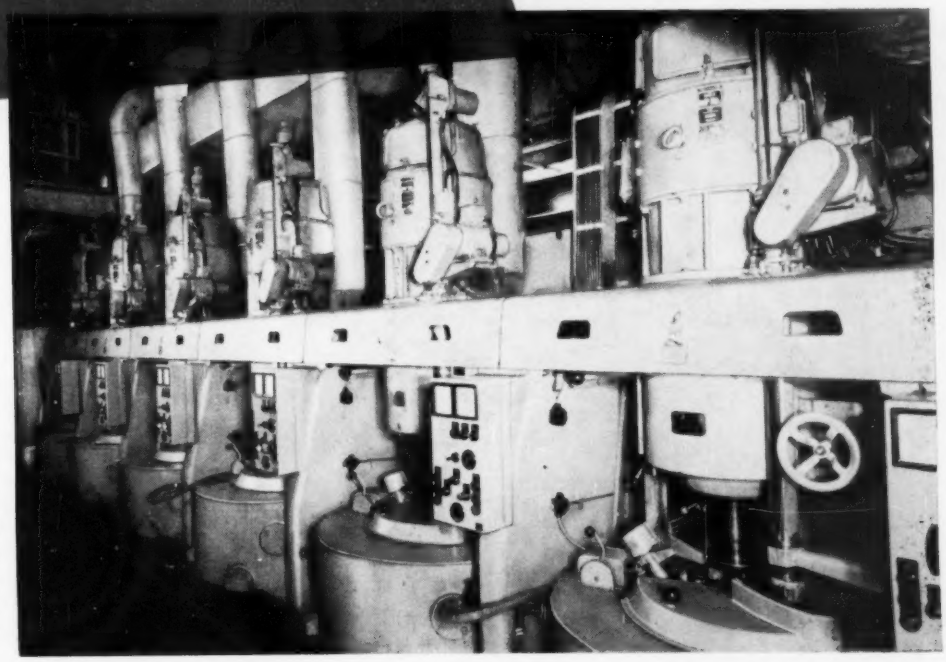

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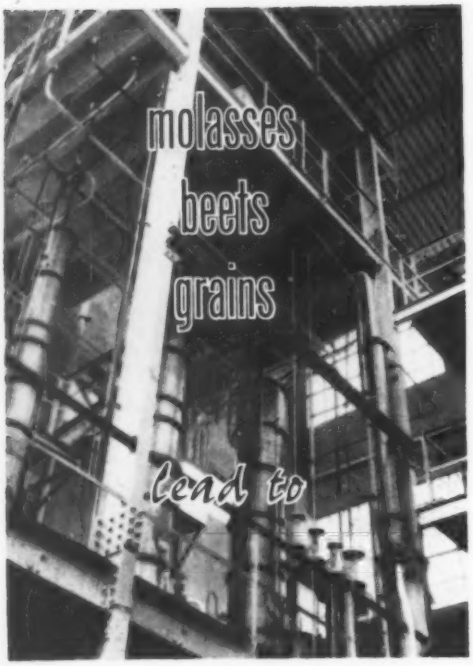

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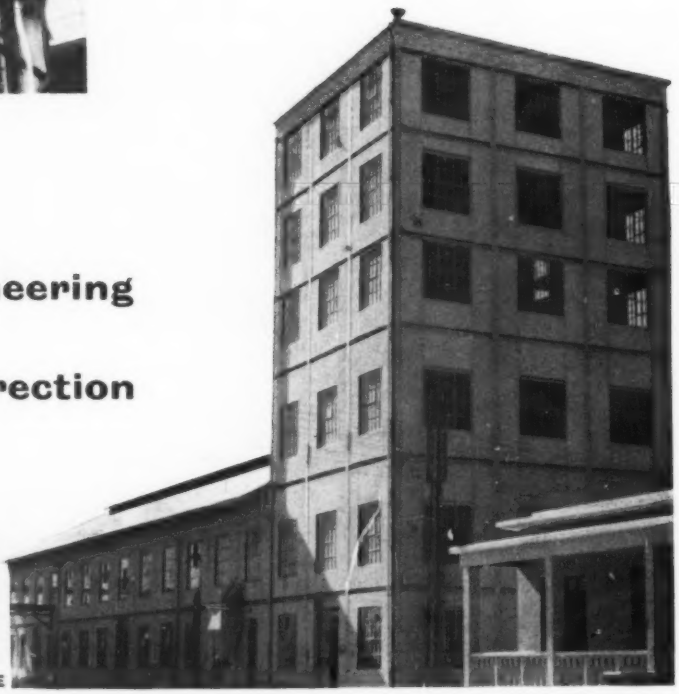

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Calculation of the yield of sucrose and nominal molasses. I. N. KAGANOV. *Sakhar. Prom.*, 1961, (4), 34.—Molasses yield (P_m) is given by $P_m = (100 - P)\frac{B_m}{85}$, where P = rendement for a given product and B_m = molasses Brix corresponding to the product in question, 85 being the dry solids of the nominal molasses. This may be simplified to $P_m = 1{\cdot}176\,(B - P)$, where B = dry solids content of the product.

* * *

Massecuite crystallization. YU. D. KOT. *Sakhar. Prom.*, 1961, (4), 34–37.—Tests have indicated the advantages of cooling massecuite in crystallizers with compressed air (at a flow rate of 1–3 m/sec, for instance) as well as the normal rotating cooling elements (at 0.6 r.p.m.). In 8–14 hr 2nd product massecuite was cooled from 77–82°C to 44°C, even at an air temperature of 28°C. No false grain was thrown out nor was there any overcooling of the upper layer of massecuite, and spinning did not suffer.

* * *

Krasnensk sugar factory after reconstruction. V. S. NOSULENKO and B. E. PLYUSHKO. *Sakhar. Prom.*, 1961, (4), 37–38.—The factory was started up in 1954 at a rated slicing capacity of 1200 tons of beet and has been modified to increase the daily slice to 2500 tons of beet. Details are given of the new equipment installed. Reconstruction took less time than would have erection of a new factory, costs were lower than those of a new factory, and sugar production costs were reduced.

* * *

Operation of a lime kiln on natural gas. N. P. TABUNSHCHIKOV. *Sakhar. Prom.*, 1961, (4), 39–45.—Reference is made to the article of V. P. MEKHEDA[1], in which an efficiency of 83–86% with a CO_2 content of the waste gases of 34% are claimed for a lime kiln modified from anthracite to natural gas burning. It is pointed out that with a gas feed as described such figures could not have been attained and that the author's calculations were inaccurate, the CO_2 content in the waste gases being 28–30%. Full analytical details are given.

* * *

A further contribution to the industrialization of the U.A.R—the Czechoslovak sugar factory near Damascus. J. ČERNÝ. *Czechoslovak Heavy Ind.*, 1961, (5), 34–43.—An illustrated description is presented of the Adra factory which is intended for a daily slice of 600–750 tons of beet with a refinery producing 100 tons of sugar per day during the beet campaign and 150 tons of sugar per day from raw cane sugar between campaigns. During the first campaign in 1959 guaranteed outputs during the beet and "refining" campaign were exceeded. No details are given of the processes.

Some impressions of the European beet sugar industry. B. J. RUTHERFORD. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 35–43.—Some details are presented of beet factory processes as seen through the eyes of one concerned with cane sugar production.

* * *

Reflections on the cossette surface and its significance, on the effect of juice velocity and packing density and on flow conditions in diffusion systems. P. L. FREUND. *Zeitsch. Zuckerind.*, 1961, **86**, 190–196, 251–259.—The application of Fick's law to beet diffusion and methods of determining the cossette surface area are covered in this detailed work in which 68 references to the literature are cited. A linear relationship is established between the specific cossette surface and the time coefficient of exchange of material and relationships are also established between the flow velocity of the extraction medium and the time coefficient of material exchange, and between permeability, specific cossette surface and the packing density in the diffuser. From the time coefficient of material exchange it has been found that above a critical lower limit, juice velocity has no effect on the extraction velocity. The juice velocity need only be sufficient to allow removal of the sugar from the cossette surface by convection. The material exchange coefficient k' increases with increasing specific surface, the relation being almost linear for the test conditions. The permeability of the cossette column falls with increase in the density of the packing as well as with increasing specific surface of the cossette. The Reynolds number is very important for the concentration equilibrium at the surface of contact of the liquid phase, and the values quoted for each type of diffuser should be adhered to as much as possible, i.e. between 7 and 17, since too high a Reynolds number is useless. The flow conditions in the diffuser give an indication of the transitional area between laminar and turbulent flow. Details and a diagram are presented of the apparatus used for the displacement method of studying cossette column permeability.

* * *

Automation in the sugar factory as regards raw material and finished product. L. PALESTRO. *Ind. Sacc. Ital.*, 1961, **54**, 83–88.—The applications and advantages of automation in the sugar factory are reviewed.

* * *

Complete return of diffusion waste water to the Robert diffuser at Velká Bystrice sugar factory. V. LOCHMAN. *Listy Cukr.*, 1961, **77**, 111–116.—Details with a flow diagram are given of the scheme for return of diffusion and press water to the diffusion battery after clarification. Disinfection with formalin has been found necessary. No difficulties have been encountered in diffusion; the effect of recirculation on yield and other factors has not been gauged, since the scheme has operated for only one campaign. A water balance is given for fresh and return water with pulp pressing to 8 and 12% dry solids. The respective proportions of fresh and return water are 31·8 and 68·2% at 8% dry solids and 23·9 and 76·1% at 12% dry solids.

[1] *I.S.J.*, 1960, **62**, 136.

NEW BOOKS AND BULLETINS

Centre Technique de la Canne et du Sucre de la Martinique, 1960 results. Fascicule 1. Varieties. 60 pp; 8 × 10 in.

Half of this brochure, interspersed with tables and graphs, describes the varietal position in the island as affected by the varying climatic and soil conditions, and indicates the bearing of the 1960 experiments on future varietal changes. The second half is devoted to a detailed tabular and diagrammatic presentation of the experimental results on which the conclusions first described are based.

* * *

Approach to Europe. ANON. 20 pp; $5\frac{3}{4}$ × $8\frac{3}{4}$ in. (Chamber of Commerce Publications, 68 Queen Street, London E.C.4.) 1961. Price: 2s 6d.

This book, sub-titled "Background to negotiations with E.E.C.," is a brief, wholly objective account of the European economic position. It gives information on the post-war history of the moves towards European unity, the aims of the European Economic Community and activities toward elimination of mutual tariffs, quotas and restrictions of capital and labour movements, etc. A similar account is given of the European Free Trade Association, while a note is provided on the other organizations in Europe. The main obstacles to U.K. membership are discussed in a serious but not pessimistic manner, together with an assessment of the present situation in both groups. Finally the position of Britain is briefly examined assuming, first, that she enters the Common Market and, second, that she does not. The concluding sentence reads "Either way, Britain faces a challenge which will demand courage, initiative and, above all, adaptability."

* * *

FAO Commodity Review 1961. 136 pp; $8\frac{1}{2}$ × $10\frac{3}{4}$ in. (Food & Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, Rome, Italy.) 1961. Price: $1.50; 7s 6d.

This work is an analysis of general influences in international commodity markets in 1960 and is in two parts. The first occupies only 21 pages and is a general survey of the 1960 situation and future outlook, while the major part deals with individual commodities. A statistical appendix is provided. A trend observed widely is the much higher growth in production than in consumption; this is well exemplified in the case of sugar, partly as a result of improved yields, greater acreages, and good weather, especially as far as the bumper European beet sugar crop was concerned. The major influence on the world market —the switch of Cuban sugar from the U.S.A. to Russia and China, and subsequent changing trade patterns—is discussed as well as future possibilities in this connexion.

Trends and forces of world sugar consumption. A. VITON and F. PIGNALOSA. 88 pp; $8\frac{1}{2}$ × $10\frac{3}{4}$ in. (Food & Agriculture Organization of the United Nations, Rome, Italy.) 1961. Price: $1.00; 5s. 0d.

Sugar production in 1945/46 was only 18 million tons and it was 1947/48 before the pre-war average of 24·6 million tons was regained. By 1958/59 production had doubled this figure compared with a 46% increase in wheat production, 30% for rice, 45% for meat, all excluding the U.S.S.R., Mainland China and Eastern Europe. Until 1959, increasing consumption kept pace with this advance at 5% compound rate of increase or an average 1·9 million tons/year. Production and production capacity continue to expand and the present work is an examination of the prospective trends in consumption, based on surveys, questionnaires and statistics gathered by the FAO. The interaction of prices, income and consumption are discussed with notes on particular countries. Other factors considered are the effects of climatic temperature, relationship between sugar and bread or rice, and the consumption of wine; the analysis does not lend support to the various theories concerning their negative influence on sugar consumption, although countries with a high consumption of fresh fruit and vegetables use slightly less sugar. It is concluded that the future trend of sugar consumption will depend largely on the tempo of economic development in the low-income countries which, however, include 68% of the population in the non-Communist world. This will depend appreciably on the taxation applied, however, since this is an important factor, especially in the low-income areas where price elasticity is high. Three estimates of consumption in 1965 and 1970 are produced; these are 56·8 million and 65·8 million metric tons, by simple extrapolation of the linear trend of 1951–57; and 55·6 million and 66·1 million, and 58·1 and 69·4 million tons based on all-log and semi-log cross-correlation equations. In view of the radical changes which would be expected if the Cuban exports to the U.S.S.R. and China were not re-exported, it is useful that a separate series of forecasts are made for the non-Communist world. The book is amply provided with tables and charts detailing the figures used in the survey.

* * *

Principios de funcionamiento del tacho al vacio. (Principles of vacuum pan functioning.) J. LÓPEZ HERNÁNDEZ. 89 pp; 6 × 9 in. (Faculty of Agronomy, National University of Tucumán, Tucumán, Argentina.) 1960.

This work, Miscellany No. 10, is a detailed account of the establishment of an equation which permits the construction of an ideal hyperbolic curve relating the decrease in total heat transfer coefficient, and velocities of evaporation and circulation with increasing massecuite height.

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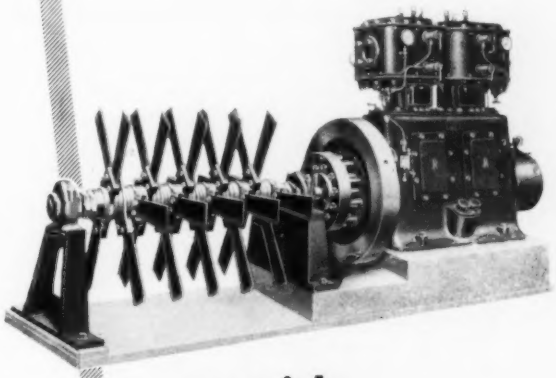

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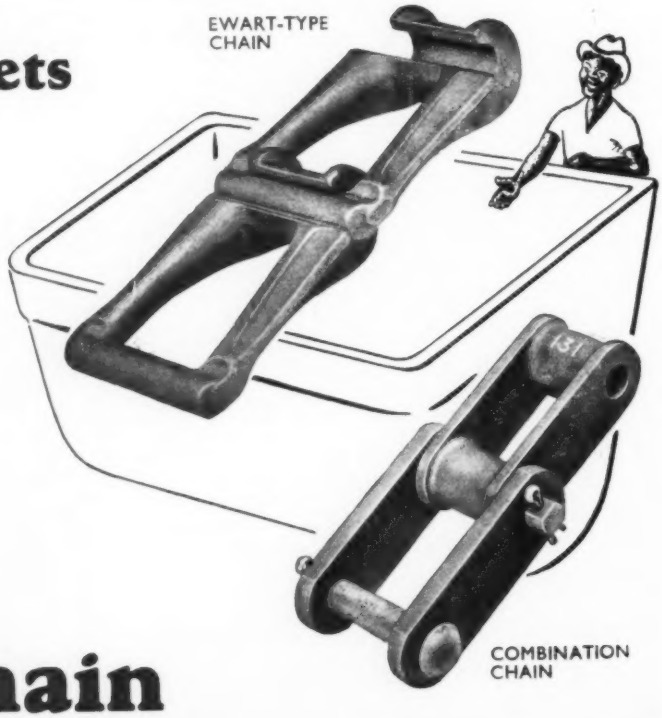

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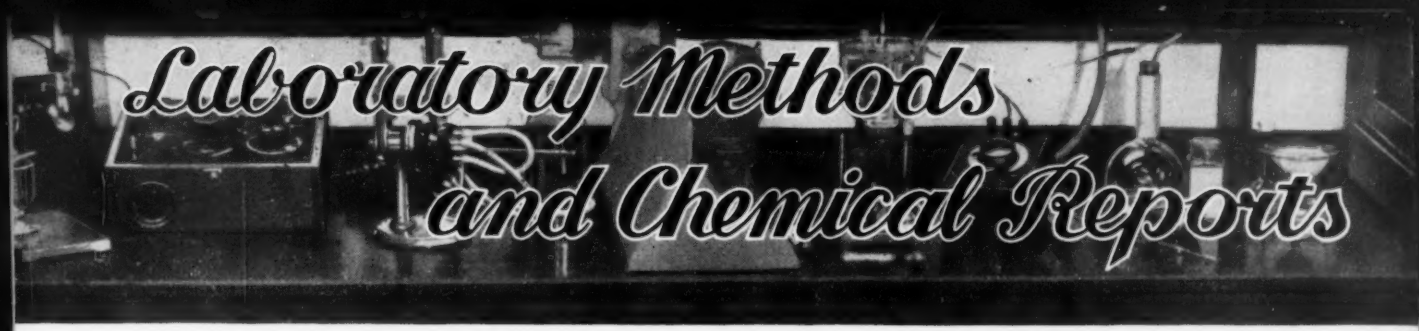

The cane analysis investigation. N. J. KING. *Australian Sugar J.*, 1961, **53**, 37–40.—Investigations, which are being continued, into cane payment have revealed that the c.c.s. formula, although reasonably accurate on a state-wide basis over a long period of time, does give inaccurate results in different seasons and may also vary from district to district. A discrepancy has been found between the direct analysis of cane using the wet disintegrator and the pol and Brix values obtained by juice weighing, the latter always providing higher figures.

* * *

Preparation of melibiase-invertase for sugar beet molasses assay of raffinose. D. D. LEETHAM and R. E. HALBECK. *J. Amer. Soc. Sugar Beet Tech.*, 1961, **11**, 302–305.—*Saccharomyces carlsbergensis* has been cultivated in the laboratory, for production of melibiase-invertase, in a modified Saboraud medium at pH 4·8 and 7·6 RDS. Details are given of the procedure for separation and purification of the enzyme which is suitable for raffinose hydrolysis.

* * *

Changes in the concentration of amino acids in sugar beet plants induced by virus yellows. J. M. FIFE. *J. Amer. Soc. Sugar Beet Tech.*, 1961, **11**, 327–333.—Details are given of paper chromatographic analyses of the juice from beet leaves of different ages removed from healthy and virus yellow-infected beet. The aspartic and glutamic acid concentrations were lower in leaves of the diseased beet at all ages, while the other amino acids were either higher or unchanged. The greatest changes in amino acid concentration occurred in the old diseased leaves, whereas in the young leaves only the leucines increased, the concentrations of the other amino acids not changing. Differences between the concentration of certain amino acids in healthy and diseased plants were sufficiently high and constant for suggesting the ratio of the acids involved as a diagnostic aid. There was considerable variation in the concentration of certain amino acids among diseased plants, indicating the possibility of selecting virus yellow-resistant beet on the basis of changes in these concentrations.

* * *

Determination of sugar in pulp from a Rotel centrifugal rasp. P. DEVILLERS and M. LOILIER. *Sucr. Franç.*, 1961, **102**, 112–113.—The sugar content of fine pulp obtained with a Rotel centrifugal rasp rotating at 3600 r.p.m. may be determined to within $\pm$ 0·01%, assuming a saccharimeter accuracy of $\pm$ 0·1°, compared with $\pm$ 0·05% with a "Turmix" or "Pellet" apparatus.

Effect of beet non-sugars especially on molasses formation. F. SCHNEIDER, A. EMMERICH, E. REINEFELD, E. WALTER, and W. KELM. *Zucker*, 1961, **14**, 208–212.—A brief survey is presented of methods adopted by various authors to define the relationship between non-sugars in beet molasses and the molasses purity. Tests were carried out in which molasses from various years and factories were after-crystallized for 130 days at 40°C with an excess of crystal sugar added. After this period, equilibrium was reached in the sucrose solubility, absolutely crystal-free syrup being obtained by ultra-centrifuging. On examination of the non-sugars composition and the molasses purity achieved, a linear relationship was established between the purity and the function

$$\frac{\%\ \text{non-sucrose} - \%\ (K + Na)}{\text{atomic weights } (K + Na)}$$

. From this, the non-sugars must be divided into two groups which affect sucrose solubility in different ways, the alkali ions giving a high purity, the other a low purity figure. This relation also applies after 4 days' crystallization.

* * *

Studies on the formation of molasses. III. Determination of melassigenic factors of univalent metals. N. A. RAMAIAH and –. VISHNU. *Sharkara*, 1960, **3**, 156–161.—The formation constant or melassigenic factor K (the reciprocal of the dissociation constant k) is a measure of the capacity of a salt to combine with sugar to form a non-crystallizable complex. Values of K are calculated for various salts and are tabulated. Graphs are also presented of changes in optical rotation with variation in the product of the concentration of sucrose or levulose times salt concentration. The data show that the melassigenic factor of K salts is greater than that of Na salts. It is thought that the sugars combine with cations of the salts to form the complex molecules, the effect of the anion on optical rotation of the complexes being apparently a Debye-Hückel effect in strong electrolytes and/or due to changes in the refractive indices.

* * *

Conversion of analytical values to dry solids contents. J. BURIÁNEK and J. BERNATOVÁ. *Listy Cukr.*, 1961, **77**, 79–85.—Comparative measures of hardness, colour, inorganic salts, etc., in sugar solutions can be obtained by dividing the value of the function by that for the sucrose present, the quotient giving the value per 100 sugar.

* * *

Coefficient of saturation of low purity sugar solutions. M. FRIML. *Listy Cukr.*, 1961, **77**, 85–90.—The coefficient of saturation of final molasses from 4

campaigns was determined at 40°C and the mean results at non-sugars:water ratios of 1·0–2·8 are compared with those of GRUT and URBAN. Approximate agreement between GRUT's values and the determined values is only occasional, the former always being lower than the latter. An empirical formula is derived from the determined values for calculation of the saturation coefficient (K_n) and takes the form $K_n = 0{\cdot}999012 - 0{\cdot}0745798\,x + 0{\cdot}02784\,x^2$, where x = non-sugars:water ratio. The effect of non-sugars on the coefficient was studied and a graph is presented of K_n *vs.* ash/water at a constant non-sugars:water ratio. At a constant non-sugars:water ratio the saturation coefficient is greater the higher is the ash concentration in the non-sugars. The CaO content may also serve as a guide; in some cases it was found that at a constant non-sugars:water ratio and ash concentration, the final molasses with a high CaO content had a lower saturation coefficient. A nomogram is presented for approximate evaluation of K_n at various values of the non-sugars:water, given the ash content in the non-sugars. No relationship was found between the coefficient and the total nitrogen content.

* * *

Factors affecting sugar filtrability. J. F. CHU and F. C. CHU. *Taiwan Sugar*, 1961, **8**, (1), 18–23.—Data are presented of filtrability tests conducted on raw sugar samples using Elliot's method[1] with a 50-mm dia. funnel for actual filtrability determination. Cane wax[2], gum[3], starch[4], and silica[5] were determined by methods described in the literature. The experimental results were analysed statistically. There was no correlation between filtrability and starch content nor between filtrability and gum concentration, while any correlation which may occur between filtrability and cane wax will be insignificant. A significant correlation was found between filtrability and the silica content.

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A micro method for the determination of sucrose in sugar cane. J. W. BROUGH. *Ann. Rpt., Central Agric. Res. Sta. for Caroni Ltd. and Ste. Madeleine Sugar Co. Ltd.*, 1959–60, 153–154; through *S.I.A.*, 1961, **23**, Abs. 157.—A sample of juice is clarified by adding 2 g of lead subacetate per 100 ml, and a 1 ml aliquot of the filtrate is diluted to 250 ml. Replicate 0·2 ml aliquots of this dilution are placed in Pyrex test-tubes. To each tube 0·8 ml of 0·025N NaOH containing 15 mg of sodium borohydride is added to reduce invert sugar to mannitol. The mixture is incubated at room temperature for 1 hr and them placed in a boiling water-bath for 5 min. Three ml of 30% HCl are then added cautiously, followed by 1·0 ml of 0·1% resorcinol in 95% ethyl alcohol, with mixing. The tubes are placed in a water-bath at 80°C for 8 min to develop the colour, which is read from the cooled solution in a spectrophotometer at 490 mμ. A solution containing 100 μg of sucrose in 0·2 ml is used as a standard. The results of five replicates are shown.

Determination of reducing sugars with 3,6-dinitrophthalic acid. T. MOMOSE, Y. MUKAI and M. WATANABE. *Talanta*, 1960, **5**, 275–278; through *S.I.A.*, 1961, **23**, Abs. 159.—A reducing sugar, heated with 3,6-dinitrophthalic acid in aqueous Na_2CO_3 solution (with sodium thiosulphate as stabilizer) gives a stable orange-red to wine-red colour in a few minutes. The reagents are (1) 1 g of 3,6-dinitrophthalic acid and 0·5 g of anhydrous Na_2CO_3 in 500 ml of water, stored in a dark bottle; (2) 100 g of anhydrous Na_2CO_3 and 25 g of $Na_2S_2O_3$ in 500 ml of water, filtered after 3 days and stored in a dark bottle and protected from CO_2. Two ml of a reducing sugar solution containing 10–100 μg/ml are mixed with 1 ml of each reagent, successively, and then heated for exactly 10 min on a boiling water bath, cooled for 3 min, and diluted to 20 ml. The absorption intensity is measured at 450 mμ; a blank test is also made. The calibration curves for pentoses, hexoses and disaccharides are distinct, but identical for different sugars in one group. Sucrose can thus be determined in the presence of glucose by tests before and after inversion. The results are accurate to ±3%.

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Study on the conductimetric measurement of ash in Taiwan sugar and molasses. I. Investigation of different statistical equations used for evaluating conductivity ash in plantation white sugar. Y. C. CHENG and W. CHEN. *Rpt. Taiwan Sugar Exp. Sta.*, 1960, (21), 49–56; through *S.I.A.*, 1961, **23**, Abs. 161.—Chemical ash and specific conductivity were both determined in 68 white sugar samples, and the accuracies of three empirical equations were compared. The results are tabulated and shown on a scatter diagram. The simplest equation of the form $y = Cx$ was only slightly less accurate than more complex equations of the form $y = a + bx$ and $y = ax^b$, and the error of 2·25% was within the permissible range. The relation found was $Y_z = 1{\cdot}3287X$, where Y_z is the chemical ash % $\times 10^{-4}$, and X is the specific conductivity in mho $\times 10^{-7}$. The ash content of the samples varied from 0·04% to 0·15%.

* * *

The effect of additive(s) on sucrose crystallization from supersaturated aqueous sucrose solutions. J. YAMAGUCHI, K. IMAZEKI and K. KANEYUKI. *Ann. Rpt. Takamine Lab.*, 1959, **11**, 75–84; through *S.I.A.*, 1961, **23**, Abs. 169.—Solutions containing 300 g of sucrose in 100 g of water were crystallized by stirring at 900 r.p.m. at 30°C. The effects of the following additives were studied: amaranth or tartrazine (1 g); glucose, sodium chloride, calcium chloride or cobalt chloride (3 g); or one of five (unspecified) surfactants (0·5 g). The progress of crystallization was studied

[1] BROWN & ZERBAN: Physical and Chemical Methods of Sugar Analysis. 3rd Edn. (Wiley, New York). 1955, p. 1051–2.
[2] *idem. ibid.*, p. 1092.
[3] *idem. ibid.*, p. 1093.
[4] *S. African Sugar J.*, 1954, **38**, 617–623; *I.S.J.*, 1955, **57**, 115.
[5] TALBOT: Quantitative Chemical Analysis. p. 449.

by measuring the refractive index of the solution. Graphs showing the weight of crystals against time and the size distribution of the final crystals, tables of calculated velocity constants, and photomicrographs of the crystals are reproduced for each treatment. In general the observed effects were smaller than the differences between the two sucrose samples used as controls. The following effects appeared to be positive: cobalt chloride retarded the rate of crystallization and reduced the crystal yield; calcium chloride accelerated crystallization, and amaranth retarded crystallization, without affecting the crystal yield; the use of tartrazine led to the production of more uniform-sized crystals. The variability of the results is emphasized.

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Treatment of raw sugar samples before analysis. F. BERGER and W. W. BINKLEY. *Paper presented to the 20th Ann. Meeting, Sugar Industry Technicians Inc.*, 1961.—Sugar samples were stored, firmly packed in glass containers closed tightly with a screw cap lid and sealed with insulating tape. The containers were opened and the sugar analysed under the described conditions. The tests were used to ascertain the effects of various procedures in sample treatment, determination of moisture and direct polarization. Two general techniques of sample handling were found to be in use, namely (1) removal, mixing and returning the sugar to the container, and (2) mixing the sugar in the container. While the first technique led to more uniform results, the sugar handled in this manner was more responsive to the moisture content of the ambient atmosphere.

* * *

Moisture analysers. J. F. DOWLING and H. J. REICHE. *Paper presented to the 20th Ann. Meeting, Sugar Industry Technicians Inc.*, 1961.—Calibration curves for the determination of moisture in raw sugar using (1) The Boonton Polytechnic Company moisture analyzer and (2) The Moisture Register Company Model G-5 are presented. The methods used and the effect of ash, invert, and the amount of sample used are discussed. A control method suitable for the determination of moisture in granulated sugar using the moisture analyser is presented. The effects of (1) the weight of sample, (2) ash, (3) invert, (4) humidity, (5) temperature, (6) time and (7) granular size on instrument readings are discussed.

* * *

Development of a new auto-analyser method for continuous measurement of sugar in refinery waste water in the presence of interfering agents. J. V. CONGDON and S. B. ZAIATZ. *Paper presented to the 20th Ann. Meeting, Sugar Industry Technicians Inc.*, 1961.—The problems of continuous measurement of sugar in refinery waste water are discussed. There are two basic problems encountered: adapting a reliable colorimetric method to a Technicon Auto Analyser and obtaining a representative and clean sample of waste water.

A rapid method of dry substance determination in sugars and sugar products. A. P. SARANIN. *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 225–229.—An aluminium foil dish containing the pre-weighed sample is placed in a vacuum cell which is then placed in a cylindrical oven fitted with an infra-red lamp. After drying during 10 min, the cell is withdrawn, the vacuum broken and the dish cooled for 1 min before weighing. For sugars a 5-gram sample is required, and for sugar products a 1-gram sample. The latter should be diluted 1:1, except juices, and placed in the dish on 3 filter papers. The procedure is as above once the product has been absorbed by the papers. Total time requirement for the determination is 20 minutes. It was found that for minimum decomposition the dish should be placed 6 inches from the lamp for an exposure of 10 min. The results are almost identical with those given by the conventional oven method, but with low purity material the new method gives a slightly higher result.

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Colour index and degree of whiteness of Taiwan plantation white sugar. W. CHEN and S. H. WU. *Taiwan Sugar Expt. Sta. Rpt.*, 1961, (23), 117–124.—The colour index and degree of whiteness (reflectance) of a number of samples of SWC from different Taiwan mills are tabulated, for the seasons 1957–58 and 1959–60, and shown to vary during the season, the order of the factories remaining the same. The high correlation between these measures (0·71) permits visual grading. Sets of 12 standard whiteness samples are prepared each campaign, their colour being determined spectrometrically, and vary by 0·02 between degrees of whiteness of 0·74 and 0·96. The test samples are placed between adjacent pairs of standards until the latter are more and less white respectively.

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Loss of sucrose in refineries due to inversion. K. DOUWES DEKKER. *S. African Sugar J.*, 1961, **45**, 341.—Using the Douwes Dekker formulae, sucrose losses in molasses are calculated for sugar boiling from a syrup of 88 purity where there is (a) no inversion, and (b) inversion of 3% of the sucrose present. It is shown that in spite of the lower molasses purity (40·87 *vs.* 44·40) sucrose in molasses increases by 0·72%, which must be added to the 3% loss.

* * *

Chemical control notes. J. P. LAMUSSE. *Mauritius Sugar Ind. Research Inst. Rpt.*, 1960, 101–103.—Comparison of hydrometer Brix and refractometric Brix using a Bausch & Lomb instrument has indicated a Boiling House Efficiency 1·023 times greater when calculated from the refractometric Brix than from the hydrometer Brix values. The purities based on refractometric Brix were intermediate between the figures based on the hydrometer Brix and the purities obtained by weighing and stock-taking.

BY-PRODUCTS

Glycerol production: a pilot-plant investigation for continuous fermentation and recovery. J. F. HARRIS and G. J. HAJNY. *J. Biochem. Microbiol. Technol. Eng.*, 1960, **11**, 9–24; through *S.I.A.*, 1961, **23**, Abs. 35.—The Neuberg method of removing acetaldehyde from a normal alcoholic fermentation system by the addition of sodium bisulphite, so that glycerol is produced (from trihydroxyacetone) instead, has been examined in order to evaluate its economic possibilities. The optimum bisulphite level, continuous fermentation conditions, and glycerol recovery and purification, have been examined in detail. A 55·5% yield of glycerol, with 40·83% of alcohol, on the amounts theoretically obtainable from sugar, was obtained. Most of the work was carried out on the fermentation of corn sugar by *Saccharomyces cerevisiae*, but some tests were made with blackstrap molasses; the only difference in the latter case was that the consumption of bisulphite increased. An economic evaluation indicates that glycerol could be produced from high-test molasses at a price well below that for glycerol synthesized from propylene, and that the utilization of blackstrap molasses deserves commercial consideration.

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Operation of a bagasse fibre plant at Central El Palmar. A. L. ENNIST. *Sugar J.* (La.), 1961, **23**, (10), 12–16.—The pilot plant at Central El Palmar, Venezuela, which commenced operations in March 1960, consists of a Rietz disintegrator, a Bauer single-disc attrition mill, a Heil dehydrator, a "Rotex" screen and a Baldwin Southwark 2800-ton hot press. Optimum results have been obtained by passing the raw bagasse through the disintegrator twice, the second time with water added for washing and removing additional pith. Screening was abandoned because efficient operation depended on a low flow rate and because much fibre was lost with the fines passing through the screens. The treated fibre is best stored in pressed mats of 9–11 lb/cu.ft. density, at an initial moisture content of 25%. Bone dry fibre yield was about 27% of the wet raw bagasse, and the fibre was clean and flexible and uniform in size. Boards which have been produced by a dry process using phenolic and urea resins are undergoing analysis.

* * *

Condensation products of glucose, fructose and sucrose with ethyl acetoacetate. H. H. SZMANT and M. L. ESTÉVEZ. *Mem. XXXIII Conf. Asoc. Técn. Azuc. Cuba*, 1959, 155–159.—Condensation of glucose and fructose with ethyl acetoacetate yields, respectively, 1-methyl-2-carbethoxy-4-(1′, 2′, 3′, 4′-tetrahydroxy-*n*-butyl)-furan and the 3-tetrahydroxybutyl derivative. The literature on preparative techniques of these compounds is discussed and conclusions are drawn as to the reaction mechanism. Use of sucrose should give a mixture of both compounds and this is confirmed by experiments when a combined yield of 20·3% is obtained by heating together 0·277 moles of sucrose, 0·500 moles of ethyl acetoacetate and 0·147 moles of zinc chloride for 7 hr, followed by 15 hr at ambient temperature. By fractional crystallization from water 60% of the mixture was isolated as the 4-substituted compound and 20% as the 3-substituted. Acetylation of the condensation product from sucrose and ethylacetoacetate yielded a mixture of the tetra-acetates of the 3- and 4-substituted furans, the latter predominating.

* * *

Manufacture of newsprint from bagasse. E. RAMOS. *Mem. XXXIII Conf. Asoc. Técn. Azuc. Cuba*, 1959, 161–166.—Account is given of recent developments at the Cardenas plant of Técnica Cubana Inc. Reasons are advanced for the non-acceptability of the bagasse newsprint produced before intervention of the plant, and it is claimed that modifications of plant and process will produce an acceptable product.

* * *

Lactic acid formation by alkaline decomposition of sucrose. D. KORF, A. VAN DER LEY, J. C. VLUGTER and H. I. WATERMAN. *Chemie & Ind.*, 1961, **85**, 408–412.—The effect of certain factors on lactic acid production by alkaline degradation under pressure[1] is discussed. In contrast to previous results[2], sucrose concentration over the range 5–60% had little or no influence. At 230°C, 4 min reaction time is adequate, the reaction between one molecule of sucrose and 3 molecules of $Ca(OH)_2$ yielding 50% of the theoretical lactic acid yield. Without excess of alkaline reagent, the yield will be less than 50%, and with great excess of $Ca(OH)_2$ the maximum yield will be 55%. Addition of calcium acetate or formate will increase the yield to 57–60%. Neither addition of NaOH nor increase in reaction temperature increases the yield.

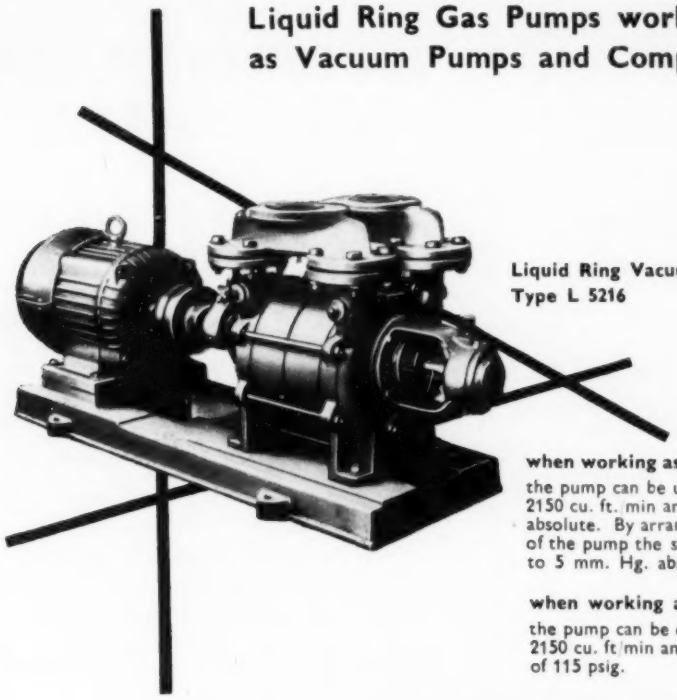
* * *

Recycling of yeast in the alcoholic fermentation of molasses. B. G. KRISHNAMURTI. *Indian Sugar*, 1961, **10**, 721–723.—A series of experiments were conducted on molasses fermentation applying yeast recycling. It was found that recycling did not suppress yeast growth nor increase alcohol yield. Sulphuric acid up to 0·1 cc per 100 cc wash appeared useful as an antiseptic, but at 0·3 cc/100 cc wash suppressed yeast growth and reduced the alcohol yield. The effect of yeast recycling is almost the same as with continuous fermentation in which most of the fermented wash is kept in the fermenter and a portion is removed periodically and fresh wash added. The principal advantages lie in clarification of the fermented wash and inhibition of scale fermentation in the still, although it does have disadvantages.

[1] *I.S.J.*, 1960, **62**, 263.
[2] MONTGOMERY and RONCA: *Ind. Eng. Chem.*, 1953, **45**, 1136–1147; *I.S.J.*, 1953, **55**, 252.

Liquid Ring Gas Pumps working as Vacuum Pumps and Compressors

Sihi PUMPS



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Type L 5216

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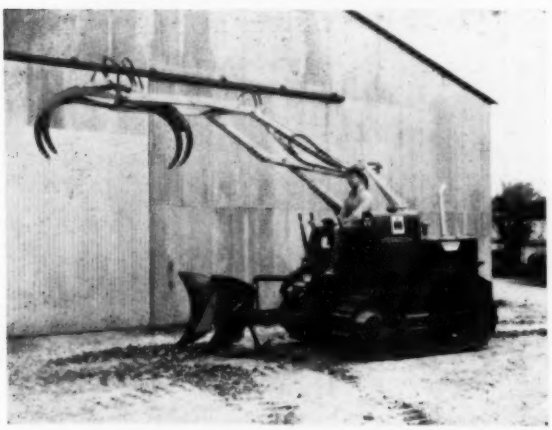

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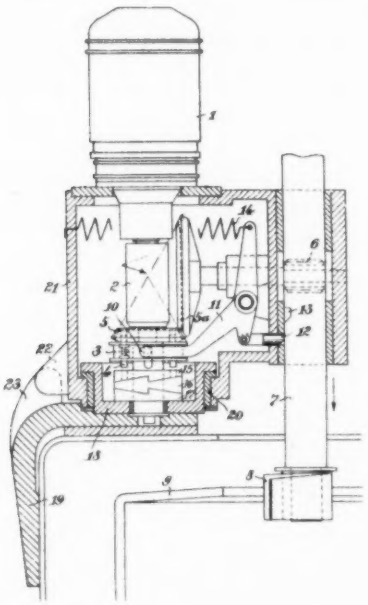
PATENTS

UNITED KINGDOM

(Automatic ploughing mechanism for) Centrifugals. GUTEHOFFNUNGSHÜTTE STERKRADE A.G., of Oberhausen, Rhineland, Germany. **872,605.** 12th November 1957; 12th July 1961.—An electric motor 1 on the centrifugal machine is connected through clutch 2 to a secondary clutch shaft carrying collar 3. This has a number of resiliant pins projecting above and below in pairs. The upper pins correspond to holes in a bevel wheel 5 which meshes with a larger bevel wheel 5a. This is mounted on a horizontal shaft which also carries pinion 6. This pinion



engages with a rack to cause the shaft 7, carrying plough 8, to move vertically. The collar 3 is moved up and down on the spindle by the forked arm of lever 11 having two rollers 10 opposite each other in a peripheral groove on the under side of the collar. The lever 11 is under the tension of spring 14 which would push the pins 4 out of engagement with wheel 5 but is prevented by locking pin 12 which presses against shaft 7 through a hole in casing 21. When the plough 8 enters the drum 9 the collar is engaged with wheel 5 and the motor drive is thus connected through wheel 5a and pinion 6 so that the shaft 7 is lowered until the notch 13 is level with pin 12. This engages, whereupon the lever 11 disconnects the collar and directs it downwards. The lower pins 4 now engage with holes in the top part 15 of a three-part dog clutch 15, 16, 17. The bottom part 17 is connected through a bush 18 to a stationary bracket 19 which also carries the rotatable housing 21 (with an interposed bronze bush). The housing 21 can move through an angle of about 20° governed by the movement of lug 22 between stops 23. On engagement of collar 3 with dog 15 the housing 21 is carried to one of these stops so bringing the plough 8 into the correct position for sugar discharge; parts 16 and 17 are held rigidly so that the part 15 (and collar 3) are forced to rise because of the wedge-shaped matching surfaces of 15 and 16. As the collar rises the lever 11 is moved against the tension of spring 14 and withdraws pin 12 from notch 13. The collar 3 engages with wheel 5 and the drive is reconnected to the shaft 7, causing it and the plough to move downwards, emptying the drum of sugar. At the bottom of the stroke a limit switch reverses the direction of the motor, causing the shaft 7 to be driven upwards. The pin 12 re-engages with notch 13 when the previous sequence is reversed and the housing swings to the other limit stop 23. The middle and bottom dogs 16 and 17 are now separated and the shaft 7 resumes its upward motion out of the drum.

* * *

Glutamic acid solution from beet sugar waste. AJINOMOTO CO. INC., of Tokyo, Japan. **872,674.** 17th September 1959; 12th July 1961.—Beet sugar waste, e.g. barium process or Steffen waste, is heated in the presence of Ca, Ba or Sr hydroxide to convert the pyrrolidone carboxylic acid to glutamic acid, CO_2 is introduced and the alkaline earth carbonate separated. The resultant solution is electrodialysed, continuously withdrawing the anionic fraction and leading this through a cation exchange resin column and eluting the adsorbed glutamic acid with an alkaline or acid solution. The electrodialysis apparatus has an acid compartment next to the anionic compartment to supply hydrogen ions to glutamic acid anions which have migrated into the anionic compartment, and also to prevent the migration of cations other than hydrogen ions from the waste solution compartment to the anionic compartment. The solution after passing through the cation exchange resin column is circulated into this acid compartment.

* * *

Beet harvester. MASCHINENFABRIK SCHMOTZER G.m.b.H., of Windsheim (Bayern), Germany. **872,691.** 21st January 1960; 12th July 1961.

* * *

Beet topper. F. A. STANDEN & SONS LTD. and P. STANDEN, of St. Ives, Hunts. **872,740.** 2nd October 1958; 12th July 1961.

Copies of Specifications of United Kingdom Patents can be obtained on application to H.M. Patent Office, 25 Southampton Buildings, London, W.C.2. (price 3s. 6d. each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C. (price 25 cents each).

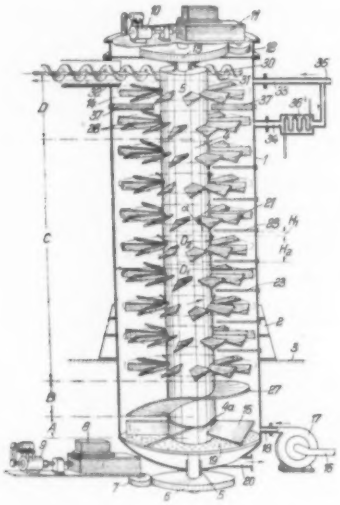
Purification of sugar juices. F. SCHNEIDER, of Braunschweig, Germany. (a) **872,957**; (b) **872,958.** 23rd December 1958; 19th July 1961.

(a) Lime and CO_2 are added simultaneously to sugar juice in a number of pH stages, the transition from one stage to the next occurring abruptly, until a final pH of 11 is reached, a portion of the muddy juice or separated muds being returned to the raw juice and/or at least one of the earlier stages, and the total quantity of non-precipitable substances and formation of calcium carbonate as a filter aid.

(b) The stages of the previous process bring the pH to 10–10 4 whereupon lime is added in an amount corresponding to the invert content of the juice and CO_2 is added to bring the pH to 11. The colloid-containing sludge is separated, a final saturation effected and the calcium carbonate sludge separated. A further small quantity of lime may be added before or during the final saturation.

* * *

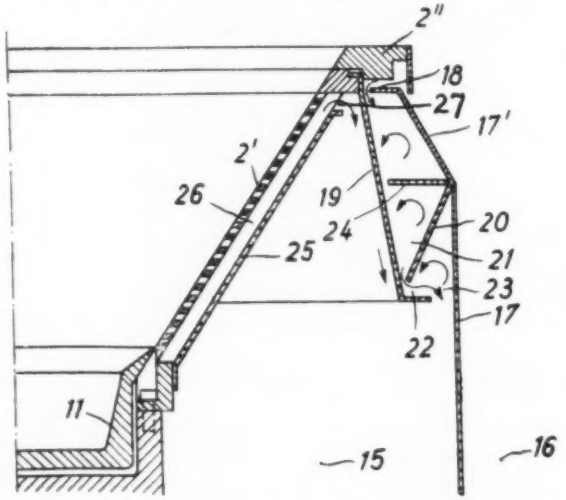
Beet diffuser. BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT, of Braunschweig, Germany. **872,717.** 14th April 1958; 12th July 1961.—The tower diffuser has four zones: (A) the stirring zone into which cossettes are pumped and from which juice is withdrawn, (B) the separating zone which lifts cossettes into (C) the treatment zone, and (D) the ejection zone. The new feature is the conveying system in zone (C) which consists of horizontal series of plane blades arranged in fan-like fashion so that the blades of one wheel are directly above and below and overlap



the gaps between blades in the adjacent wheels. Guide plates 23 are fastened on the inside wall of the tower and project into the free spaces. Their angles may be adjusted from the outside but they are normally horizontal or parallel to the blades 21 so that they have no appreciable effect on flow. It has been found that movement of blades 21 causes a pressure zone on their upper surfaces and a suction zone on their lower surfaces; these combine with the difference in density between cossettes and juice to direct the cossettes upward, the guide plates not interfering with flow and thus minimizing pulp formation in the tower.

* * *

Continuous centrifugal. HEIN, LEHMANN & CO. A.G., of Düsseldorf, Germany. **872,969.** 12th February 1960; 19th July 1961.—Massecuite treated in the continuous centrifugal is separated on the conical screen 2′ into sugar which passes over the top of the basket 2″ into zone 16 and molasses which passes through the screen and eventually enters zone 15. To prevent mixing, a series of frusto-conical baffles 19, 20, 25 are fitted; rotation of 19 and 25 with the



screen causes air currents in the direction of the arrows so that the presence of baffle 25 aids passage of molasses through the screen and baffles 19, 20 cause downward air currents particularly through the gaps 18, 22 to prevent the upward flow of molasses over partition 17′ and into the sugar.

* * *

UNITED STATES

Carbohydrate monoesters. V. R. GAERTNER, assr. MONSANTO CHEMICAL CO., of St. Louis, Mo., U.S.A. **2,973,353.** 29th June 1956; 28th February 1961.—The esters are water-soluble carboxy [carboxylic acid (K) salt] carboxylic acid monoesters of carbohydrates of no more than two saccharide units (sucrose, sorbitol), the acid having 10–25 C atoms and there being no more than 3 C atoms between the carboxy group and the carboxylic acid ester group [an alkenyl succinic acid of at least 6 C atoms in the alkenyl group, a β-carboxyaliphatic carboxylic acid of 10–25 atoms (tri-isobutenylsuccinic acid)].

Greece Sugar Imports, 1958-1960[1]

	1960	1959	1958
	(*Metric tons, refined sugar*)		
Source:			
Argentina	0	0	2,294
Brazil	0	0	3,817
Cuba	31,265	38,291	52,771
Dominican Republic	4	5,830	4,618
Mexico	5,003	23,850	29,471
United States	12	73	10,218
Venezuela	0	109	4,294
Total Americas	36,284	68,153	107,483
Belgium	0	0	512
Czechoslovakia	7,676	15,110	10,081
France	0	8	14
Germany (East)	3,377	9,994	0
Hungary	19,668	5,603	0
Italy	0	197	9
Netherlands	0	6	2
Poland	53	4,888	7,321
United Kingdom	67	642	288
Yugoslavia	25,281	8,269	0
Total Europe	56,122	44,717	18,227
Taiwan	0	2,425	0
Other countries	0	139	20
GRAND TOTAL	92,406	115,434	125,730

BREVITIES

Danish sugar export plans[2].—The Danish sugar industry is planning to import raw cane and beet sugar for refining and to export the finished product. An effort will be made to sell the white sugar in Britain and to secure a larger share of the Norwegian market.

* * *

Sugar production in Yugoslavia[3].—Preliminary data indicate that sugar production in the 1960/61 season was 265,000 metric tons compared with 247,224 tons in 1959/60. This figure is a post-war record and is from a beet crop of 2,320,000 tons. It permitted the average consumption to rise from 13·82 kilos to 14·47 kilos per head in 1960

* * *

Mexican sugar production forecasts[4].—New estimates of Mexican sugar production have been worked out by the National Union of Sugar Producers. The 1961/62 crop is put at 1,800,000 metric tons, white value, which compares with the latest estimate of 1,448,441 tons for 1960/61—an increase of 24·3%. Production in 1962/63 and 1963/64 will depend on further development of home and export demands but are set at 1,950,000 and 2,060,000 metric tons, respectively, or 34·6 and 42·2% higher than the 1960/61 figure, respectively.

* * *

Afghanistan sugar prospects[5].—Domestic requirements in Afghanistan may be estimated at about 30,000 metric tons, raw value. There is one beet sugar factory working at Baghlan. In 1958/59 it processed 35,359 tons of beets into 4,723 tons of white sugar. The cane sugar factory at Jalalabad which had been opened late in 1958 was closed down again as it was unremunerative. The Government now plans to reconstruct it as a combined cane and beet sugar factory and a further beet sugar factory is to be built at Herat. During recent years most of the domestic requirements have been met by imports, almost exclusively from the Soviet Union.

BREVITIES

Record Trinidad sugar crop[6].—In the 1961 crop sugar production in Trinidad will set a new record at 245,677 tons compared with the former record of 217,663 tons set in 1960. Of this quantity, 30,000 tons will be necessary to cover domestic requirements but it is expected that the remainder will be exported.

* * *

Burma sugar situation[7].—The total capacity of the three Government-controlled factories amounts to about 40,000 metric tons, refined value. This is not sufficient to cover domestic requirements which are rising considerably. The capacity of the factories is therefore to be raised in the future to 60,000 metric tons while a fourth factory is to be erected in the district of Hninpale and Bilin. It is hoped by this expansion to reach self-sufficiency in sugar.

* * *

Argentina and the International Sugar Agreement[8].—Following negotiations between the U.S.A. and an Argentine Economic Mission it was announced that Argentina will join the International Sugar Agreement. At present she has an exportable sugar surplus of 300,000 tons. The U.S.A. will sympathetically examine the possible Argentine request for a supply quota in the event that further quantities of sugar should be wanted this year.

* * *

Sugar production in a wattle bark factory[9].—It is reported that a factory at Melsetter in Southern Rhodesia which extracts tanning material from wattle bark has started to produce sugar from cane during the period August–November when the bark cannot be stripped and it would otherwise be closed. The cane is treated in the same fashion as the wattle bark, viz. it is passed through bark choppers and then leached with water to extract the sugar in the form of a diffusion juice. It is hoped to produce 1000 tons of sugar next season.

* * *

Large sugar mill for Argentina[10].—The 6000–7000 tons/day cane crushing tandem to be supplied by Cie. de Fives Lille–Cail to Ingenio Ledesma in Argentina is claimed to be the largest in the world. It will comprise six three-roller mills, $43^{5}/_{16} \times 84$ inches, with a maximum hydraulic load of 800 tons per mill, and is scheduled to go into service in June 1962. Each mill will be driven by a steam turbo-reducer set of 1150 h.p. maximum capacity, coupled to a monobloc enclosed reducing gear which transmits the drive directly to the rollers at a speed which may be adjusted between 3·25 and 6·5 r.p.m.

* * *

New Japanese beet sugar factories[11].—The Japanese Ministry of Agriculture and Forests has licensed erection of two further beet sugar factories on the island of Hokkaido in the north of Japan, where 7 factories already exist. One of the new plants will be erected by the Dai-Nippon Sugar Manufacturing Co. Ltd. at Honbetsu-Cho in the east of the province of Tokachi and is to be finished within one year, taking part in the 1962 campaign, with a slicing capacity of 1200 metric tons/day. The second factory, also of 1200 tons capacity, will be erected at Shimizu-cho in the west of Tokachi province by Hokkaido Farmers Economic Union (Hokuren), and is also to be opened in the 1962 campaign.

[1] *Lamborn*, 1961, **39**, 162.
[2] *Public Ledger*, 15th July 1961.
[3] F. O. Licht, *International Sugar Rpt.*, 1961, **93**, (Supp. 11), 145.
[4] F. O. Licht, *International Sugar Rpt.*, 1961, **93**, (Supp. 11), 148.
[5] F. O. Licht, *International Sugar Rpt.*, 1961, **93**, (5), 86.
[6] F. O. Licht, *International Sugar Rpt.*, 1961, **93**, (Supp. 13), 173.
[7] F. O. Licht, *International Sugar Rpt.*, 1959, **93**, (5), 88.
[8] F. O. Licht, *International Sugar Rpt.*, 1961, **93**, (Supp. 12), 154.
[9] *Umtali Post*, through *Producers' Review*, 1961, **51**, (6), 45.
[10] *Producers' Review*, 1961, **51**, (6), 37.
[11] F. O. Licht, *International Sugar Rpt.*, 1961, **93**, (Supp. 12), 161.

BREVITIES

India cane and sugar crop estimates.[1]—The final estimates in respect of the 1960/61 sugar crop, compared with the revised final figures of the previous season are as follows:

	1960/61	1959/60
Area (acres)	5,734,000	5,220,000
Cane production (tons)	85,045,000	75,201,000
Production (in terms of gur, tons)	8,690,000	7,671,000

The above figures represent new records not only for the growing area but also for production of both cane and sugar in terms of gur. The national average of cane per acre for 1960/61 is calculated at 14·8 tons or 3% higher than in 1959/60.

* * *

Sugar factory for Nigeria.[2]—The Nigerian Sugar Syndicate Advisory Committee has recommended the immediate formation of The Nigerian Sugar Company to grow sugar cane on 6500 acres of rich irrigable land at Bacita in Ilorin Province, Northern Nigeria, and to produce sugar in a factory beside the plantation. From experiments carried out by Booker Bros. McConnell & Co. Ltd.,[3] it is estimated that the factory's initial level of production will be at least 25,000 tons of sugar per annum. The project will involve an investment of £3,750,000 and it is planned to bring the factory into production at the end of 1963.

Stock Exchange Quotations

CLOSING MIDDLE

London Stocks (*at 18th September*, 1961)	
Anglo-Ceylon (5s)	12/9
Antigua Sugar Factory (£1)	6/3
Booker Bros. (10s)	22/3
British Sugar Corp. Ltd. (£1)	24/3
Caroni Ord. (2s)	4/–
Caroni 6% Cum. Pref. (£1)	12/–
Distillers Co. Ltd. (10s units)	36/3
Gledhow Chaka's Kraal (£1)	22/6
Hulett & Sons (R1)	9/
Jamaica Sugar Estates Ltd. (5s units) ..	4/–
Leach's Argentine (10s units)	27/3
Manbré & Garton Ltd. (10s)	40/
Reynolds Bros. (£1)	27/–
St. Kitts (London) Ltd. (£1)	16/6
Ste. Madeleine (Ord.) (£1)	27/9
Sena Sugar Estates Ltd. (10s)	9/1½
Tate & Lyle Ltd. (£1)	47/4½
Tate & Lyle Investments Ltd. (5s)	16/–
Trinidad Sugar (5s stock units)	39/6*
United Molasses (10s stock units)	31/3
West Indies Sugar Co. Ltd. (£1)	14/6

*Ex 4/- special capital dividend

CLOSING MIDDLE

New York Stocks (*at 16th September*, 1961)	$
American Crystal ($10)	48
Amer. Sugar Ref. Co. ($25)	32⅝
Central Aguirre ($5)	25¾
Cuban American ($10)	16⅜
Great Western Sugar Co.	33
South P.R. Sugar Co.	22½
United Fruit Co.	25½

Argentina crop losses[4].—Three periods of frost, affecting the provinces of Tucumán, Salta and Jujuy, have reduced the crop by an estimated proportion of 30–40%.

* * *

New Factory for Mozambique[5].—The Portuguese Government has been asked to approve the establishment of a new sugar factory in the district of Manica and Sofala. The new plant is to have an annual sugar production capacity of 60,000 tons.

* * *

Corrigenda.—In our notice on the 11th Congress of the I.S.S.C.T. to be held in Mauritius in October 1962[6] the first of the seven main sections should have been "Engineering" and not "Milling", while contributions of purely local interest should be *excluded* instead of included.

* * *

Polish sugar factory for Indonesia[7].—Under an economic agreement signed early in August, Poland will grant Indonesia credit to the value of £10·7 million for the construction of industrial concerns including a sugar refinery, according to Reuter.

* * *

Bulk reception at New Farm Refinery[8].—New Farm Refinery, Brisbane, Queensland, has converted to reception of bulk raw sugar from all its supplying mills. Sugar will arrive in 12-ton bottom-dumping semi-trailers, tipper trucks or in open topped rail cars; it will fall or be dropped by grab (from the railcars) into a receiving hopper which feeds mobile and reversible conveyors to the store and the cutting-in station. New weighbridges have been built as well as a raw sugar store constructed with ribbed aluminium walls on a thick concrete wall base and a ribbed aluminium ceiling. Sugar is piled by a thrower on the last mobile conveyor.

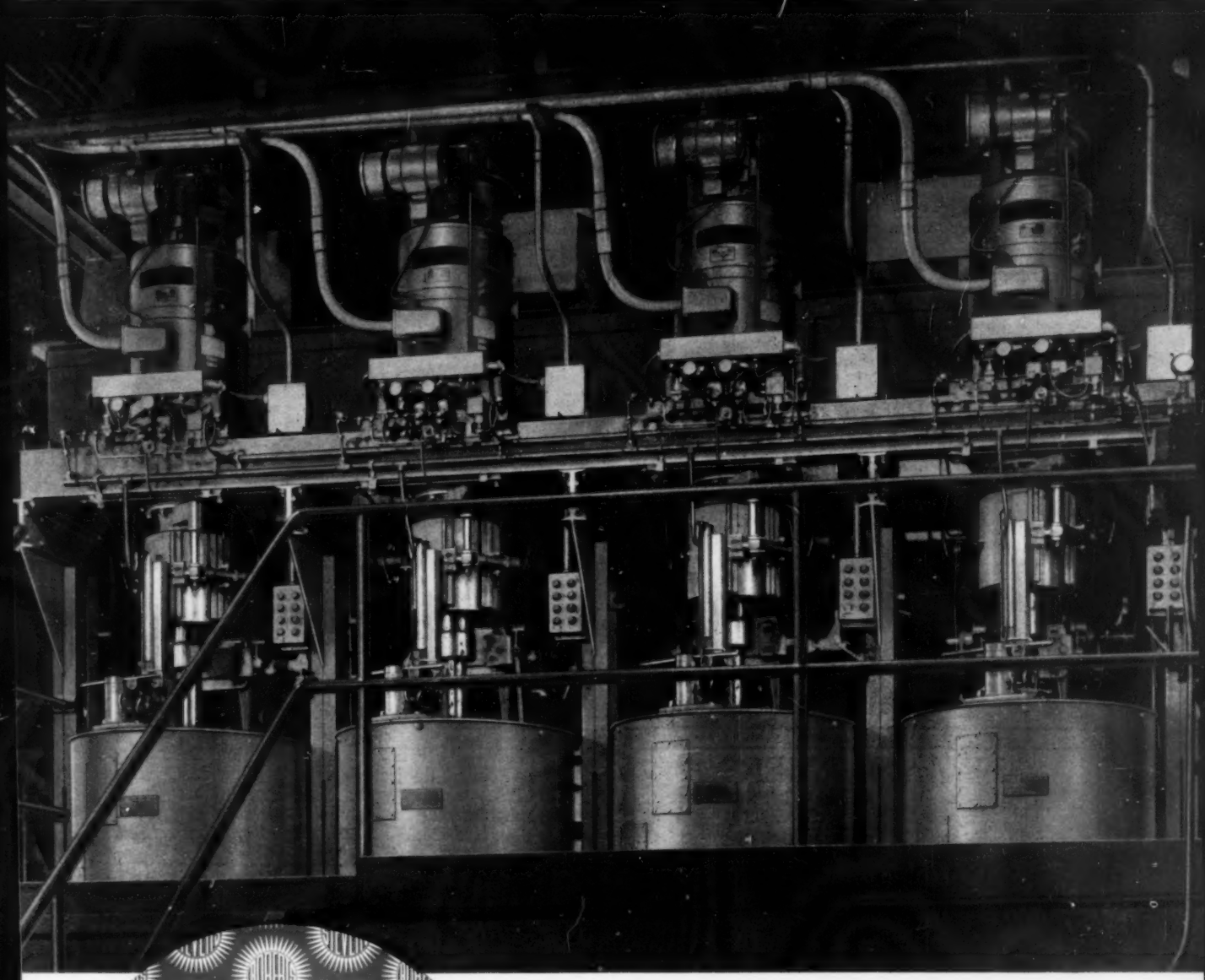
* * *

U.S.S.R. sugar production estimates[9].—According to an ADN news agency report, 24 sugar factories built in the first two years of the current Seven-Year Plan enabled sugar production to rise by 6% from the 6 million tons produced in 1959. In 1961 it is estimated that 8,640,000 tons will be produced. Seventeen factories were opened in the Russian S.F.S.R., the Ukraine, Kirgiz and Moldavian Republics this year, while a further 48 will be built in Kazakhstan, Lithuania, the Altai region and Volga districts by the end of 1965. At present the daily capacity of the Soviet sugar factories is 50,000 tons of beets; by the end of 1965 this is to be raised to 320,000 tons.

* * *

Ghana sugar developments[10].—Final arrangements are now being made concerning the establishment of the cane sugar industry at Komenda near Cape Coast and a consortium of Dutch concerns has been invited to sign contracts with the Government. A sugar estate will be established and the work will involve the clearing and cultivation of land estimated at 8000 acres together with the necessary irrigation works. A cane sugar factory with a milling capacity of 1000 tons of cane a day is to be built within two years with an extension to a capacity of 1500 tons daily within a further two years.

[1] *Public Ledger*, 19th August 1961.
[2] *Northern Nigeria News*, 1961, **3**, (3), 3.
[3] *I.S.J.*, 1961, **63**, 266.
[4] F. O. Licht, *International Sugar Rpt.*, 1961, **93**, (Supp. 12), 155.
[5] F. O. Licht, *International Sugar Rpt.*, 1961, **93**, (Supp. 12), 159.
[6] *I.S.J.*, 1961, **63**, 223.
[7] C. Czarnikow, Ltd., *Sugar Review*, 1961, (521), 147.
[8] *Australian Sugar J.*, 1961, **53**, 297–301.
[9] F. O. Licht, *International Sugar Rpt.*, 1961, **93**, (7), 122.
[10] *Overseas Review* (Barclays D.C.O.), September 1961, p.61.



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Index to Advertisers

	PAGE
Ashworth & Parker Ltd.	xlix
Blairs Ltd.	Inside Front Cover, xxxi
Thomas Broadbent & Sons Ltd.	i
Broussard Machine Company	li
Braunschweigische Maschinenbauanstalt	x
Buckau R. Wolf A.G.	xvii
Buell Ltd.	lv
Buttner-Werke A.G.	xli
Cary Iron Works	lv
Clydesdale Chemical Co. Ltd.	xiv
Cochran & Co. Annan, Ltd.	xlii
Cocksedge & Co. Ltd.	v
George Cohen, Sons & Co. Ltd.	xlix
A. F. Craig & Co. Ltd.	xxx
Crofts (Engineers) Ltd.	xxxvi
A/S De danske Sukkerfabrikker	xxvi
Dorr-Oliver Inc.	Inside Back Cover
Edwards Engineering Corp.	xii
Electromagnets Ltd.	ii
English Electric Co. Ltd. Plant Sales Divn.	vi
Escher Wyss Ltd.	vii
Ewart Chainbelt Co. Ltd.	liv
E. Farrell & Son Ltd.	l
Ferguson Perforating & Wire Co.	lvi
Soc. Fives Lille—Cail	viii
George Fletcher & Co. Ltd.	Outside Back Cover
Fontaine & Co.	liv
E. Green & Son Ltd.	xxxix
Gruendler Crusher & Pulveriser Co.	ix
G. M. Hay & Co. Ltd.	xviii
Hein, Lehmann & Co. A.G.	xix
N. A. Helmer	liv
Fr. Hesser Maschinenfabrik A.G.	lviii
Amandus Kahl Nachf.	xlvi
Kingston Industrial Works Ltd.	xxi
AB. Landsverk	xlvii
Link-Belt Co.	xiii
E. C. Masson	liv
Metrimpex, Budapest	xvi
L. S. Miedema Landbouwwerktuigenfabriek N.V.	lvi
Mirrlees Watson Co. Ltd.	iii, xliv
New Conveyor Co. Ltd.	xxiii
Nordiska Maskinfilt AB.	lvii
Norit	xliii
Paterson Engineering Co. Ltd.	xl
Pennine Chainbelt Co. Ltd.	l
Pott, Cassels & Williamson Ltd.	xxxiv
Ransomes, Sims & Jefferies Ltd.	xxix
Rotameter Mfg. Co. Ltd.	xxii
Sackfilling & Sewing Machine Syndicate Ltd.	iv
Salzgitter Maschinen A.G.	xxiv
Siemen & Hinsch m.b.H.	li
Richard Simon & Sons Ltd.	lvii
A. & W. Smith & Co. Ltd.	xxxii, xxxiii
S.P.E.I. Chim.	xlviii
Duncan Stewart & Co. Ltd.	xxxvii
Stork-Werkspoor N.V.	xi
Suchar Sales Corporation	xxxviii
Sugar Manufacturers' Supply Co. Ltd.	xxxv
Thames Packaging Equipment Co. Ltd.	xlv
John Thompson Water-Tube Boilers Ltd.	xxv
Toyo Chemical Engineering Co. Ltd.	xx
Watson Laidlaw & Co. Ltd.	xxviii
Western States Machine Co.	liii
Joseph Westwood & Co. Ltd.	li
Yorkshire Imperial Metals Ltd.	xv

FOR BUYERS' GUIDE SEE JULY ISSUE pp. liv-lxviii

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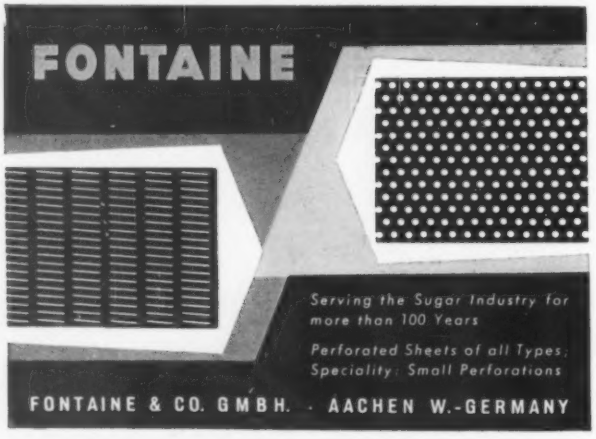
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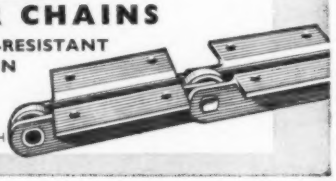

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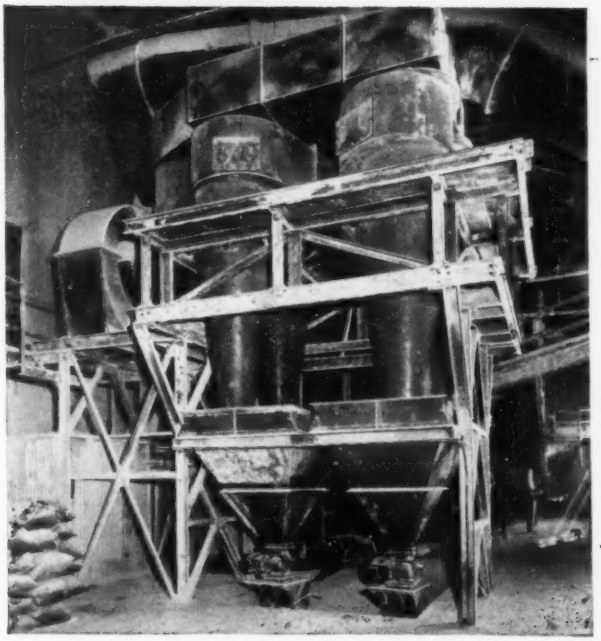

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For terms and conditions of service see para 4 below.

2. **CHIEF ENGINEER**: Should be a qualified Mechanical Engineer over 40 years of age with extensive experience in sugar factories, workshop practice and maintenance of factories, and at least 5 years' experience as Chief Engineer in an electrically operated sugar factory, and capable of efficiently running the factory.

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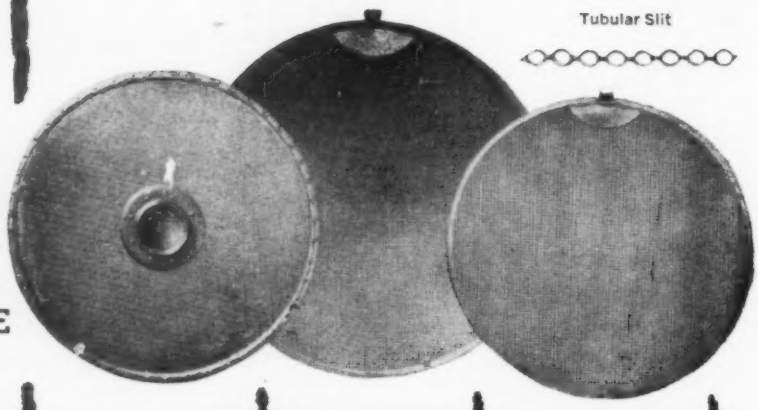

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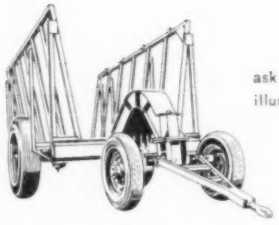

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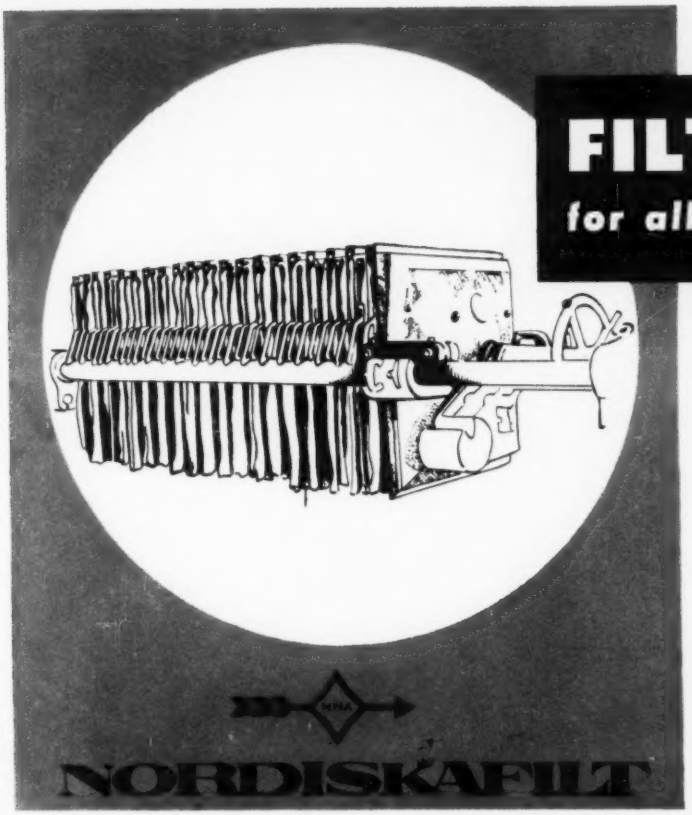

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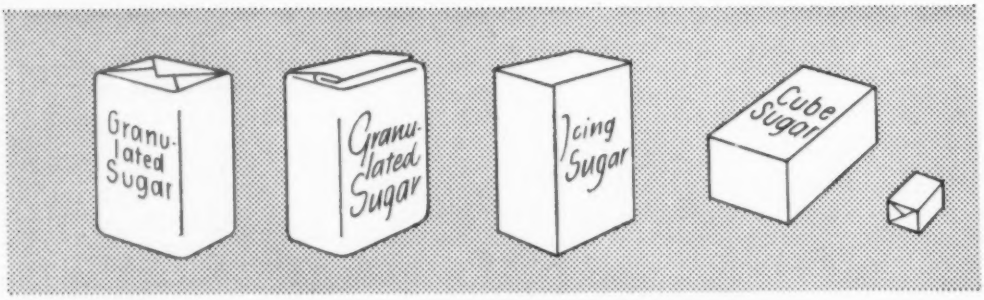

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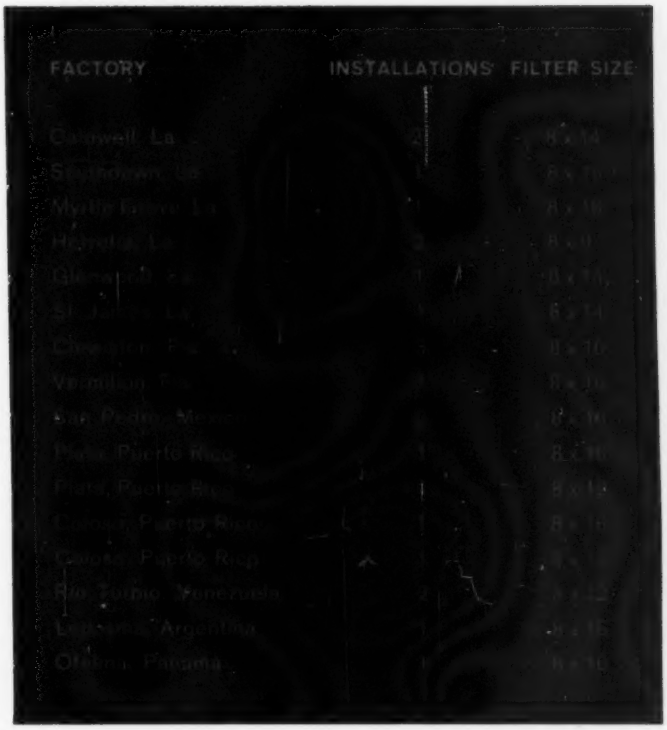

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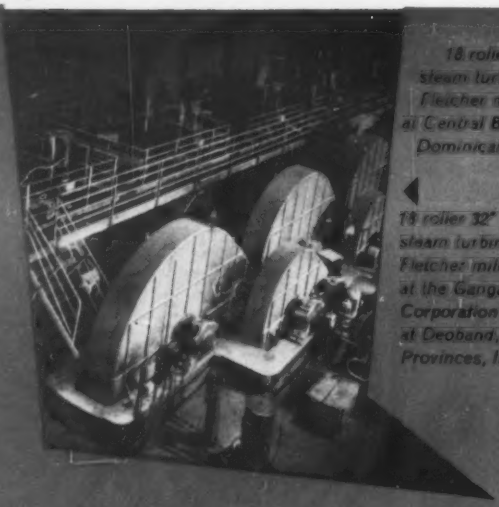
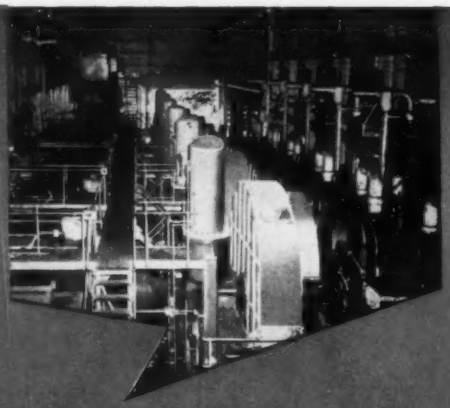


18 roller 34" x 66" steam turbine driven Fletcher mill tandem at Central Boca Chica, Dominican Republic.

18 roller 32" x 60" steam turbine driven Fletcher mill tandem at the Ganga Sugar Corporation's factory at Deoband, United Provinces, India.



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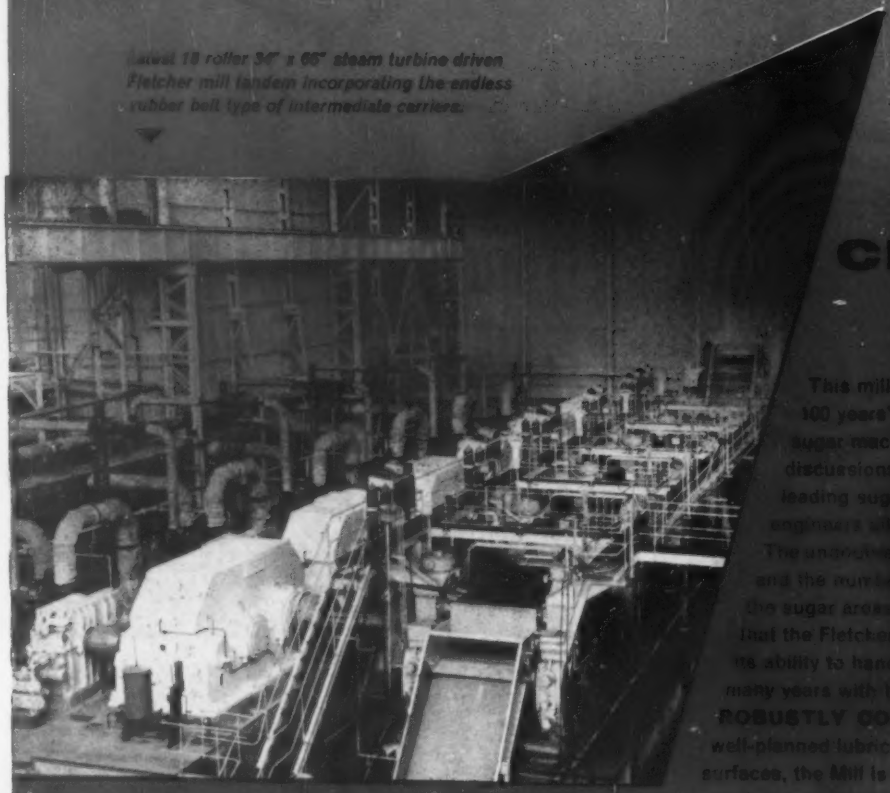

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